P L E U R I S Y

(ITS SYMPTOMATOLOGY, DIAGNOSIS,
PROGNOSIS, AND
TREATMENT)

Being

A Thesis for the Degree of Doctor of Medicine of the University of Edinburgh

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1910.

Cadnant Park,
CONWAY,
N. Wales.

April, 1910.

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S Y M P T O M A T O L O G Y.

CLINICAL FEATURES.

Pleurisy (syn.: morbus lateralis; pleuritis; morbus pleuriticus - Celsus; pneumonia pleuritis - Cullen; pleurésie; rippenfellentzundung; brustfellenzündung; seitenstich),- which is an acute or chronic, primary or secondary, circumscribed or general, inflammation of one or both pleural membranes, and, as a rule, characterised by the formation of a fibrinous, serofibrinous, or purulent exudation,- occurs in several varieties, each with a distinctive symptom-complex, as follows:

I.- FIBRINOUS or DRY PLEURISY.

The symptoms of fibrinous pleurisy (syn.: dry pleurisy; acute plastic pleurisy),- which is an acute or chronic inflammation of the whole or a part of the pleural membrane, with exudation on the surface of the latter as its prominent characteristic,- admit of considerable variation; for the affection may be of sudden or gradual onset, primary or secondary, or acute or chronic. More or less pronounced respiratory phenomena and much constitutional disturbance usually attend the acute form. There are seldom any prodromal symptoms, and a severe pain in the side of the chest is generally the first thing of which the patient complains.

The thoracic PAIN us usually described as sharp, cutting, or lancinating in character. In the larger proportion of cases of moderate severity and easily endured, it sometimes reaches a degree of violence which occasions the patient intense and almost unbearable suffering. Thus, we occasionally come across cases of acute pleuritic pain which even the largest doses of morphia seem powerless to relieve, and in which the facial expression, the cries and contortions of the patient recall vividly the agony of a biliary or renal calculus. As a rule, however, the pain is only moderate in degree. It is certainly felt oftenest at the seat of inflammation; and since this is usually the lower and lateral regions of the implicated membrane, owing probably to the greater mobility and consequent susceptibility of these parts, it is here also that the pain is usually experienced - either just outside the nipple, or in the axillary line, or behind near the angle of the scapula. In exceptional instances it is referred to the terminations of the intercostal nerves, and may then be located a considerable distance from the seat of inflammation - often lower down or farther forward. It is very rarely experienced upon the side opposite to the one diseased, or even at the umbilicus - thus

suggesting a grave a grave abdominal affection. Anything which increases the respiratory movement of the inflamed surfaces will greatly aggravate the pleuritic pain.

The patient generally endeavours to avoid this by POSTURE; but since local pressure is equally painful, this attempt is often fruitless. Perhaps the majority of sufferers lie upon the unaffected side, fearing the pressure of the weight of the body more than the increased respiratory movements. Others lie upon the affected side - assuming, however, a semirotated position: so that, while the respiratory excursions are restrained, there is no direct pressure upon the region involved.

Few things aggravate the pain of pleurisy so much as the COUGH: hence the cough which usually attends the onset of the disease has a somewhat peculiar character; it is short, superficial, suppressed - forcibly held back, as it were, by the patient. This cough is seldom entirely wanting during the first few days of a dry pleurisy. It is dry, or at most only attended by the slightest exaggeration of the bronchial mucus. Its cause is doubtful. A direct pleuritic origin has always been assumed until Nothnagel insisted that artificial irritation of the pleura was powerless to provoke a cough, and ascribed that in question to an accompanying bronchitis; but his experiments have not been confirmed, and the point is therefore still a mooted one. The cough of pleurisy usually persists until the inflammatory process either has subsided or has proceeded to an abundant exudation of liquid. The pain also, after remaining at its acme during perhaps the first two or three days, gradually disappears, even in cases in which the continuance of the inflammatory process is indicated by the occurrence of a a loud and constant friction sound.

Another very common symptom of acute dry pleurisy is DYSPNOEA; this is not excessive as in pneumonia, though there is a variable increase in the rapidity of respiration, according to the amount of the pain. The latter is made less severe by a more shallow, and therefore of necessity more rapid, respiration, leading to as little as possible of friction of the inflamed surfaces of the pleural membrane.

Usually the patient has only very moderate CONSTITUTIONAL SYMPTOMS. A chill is rare. The temperature rises at once to 102. or 103. F., remains there for two or three days, and then rapidly falls to normal. Certain cases depart from the type described above as representative of dry or acute idiopathic pleurisy. It is a well-known fact that many primary pleurisies, possibly even a majority, are neither suspected nor detected during life. Purely secondary forms will hardly account for the enormous frequency of pleural adhesions as disclosed upon post-mortem examination. We can only infer that in very many cases a primary pleurisy may develop insidiously or painlessly, and run its course to the production of newly-formed tissue, but with none of the accompaniments of an acute inflammatory process. This would also further appear from the well-recognised clinical fact that a condition of enormous thickening of the pleura, with secondary involvement of the pulmonary septa and subsequent fibroid contraction, may develop without pain and unknown to the subject of the disease. Again, it is a matter of

daily observation to find, especially in pulmonary tuberculosis in which the attention is constantly called to the chest, well-marked friction, although neither pain nor other respiratory or constitutional disturbances have suggested pleurisy. It is therefore to be regarded as comparatively frequent for a dry pleurisy to pursue throughout an absolutely latent and unrecognised course, which may exceptionally result in an important series of changes in the pleura and adjacent lungs: these will be included under the heading of Pleural Adhesions later on. Little need be said regarding the symptoms of the secondary dry pleurisies such as complicate the various pulmonary inflammations, notably croupous pneumonia and tuberculosis of the lungs. The disease is then but a more or less trivial incident in the course of the primary disease, and its symptoms are not infrequently wholly merged in those of the latter. In pneumonia it is probable that much of the acute pain is due to the complicating pleurisy; and in phthisis pulmonalis, when the pleural inflammation is less acute and widespread, it may, as stated, give rise to no distinctive and rational symptoms whatever, or the presence of somewhat transitory and fleeting pains about the scapula and shoulder may suggest its existence.

PHYSICAL SIGNS.

There is a peculiar lack of physical signs in cases of acute dry pleurisy. The only prominent one, indeed, is FRICTION. Percussion is unaltered; and a diminished respiratory murmur, which might theoretically be presumed from the shallowness of respiration, has little or no clinical existence. Friction, however, more than compensates for the paucity of other signs, because of its great constancy and pathognomonic character. When heard, it is conclusive evidence of pleurisy, though the latter may undoubtedly exist without friction. As a rule, friction is one of the most easily recognisable and most distinctive of all the sounds which originate in the chest cavity. Once heard, it is ever afterwards unmistakable. Its rough, grating character is precisely what would be expected from the friction of two moist roughened surfaces. It usually accompanies both inspiration and expiration, beginning with the end of the former, and occupying nearly the whole of the latter. A deep inspiration may at times be necessary for its production. Its character is usually jerky; it is made up of separate rubs, which give the impression as if one pleural surface moved over the other by a succession of hitches. Sometimes its quality is creaking like that of new leather; again, it resembles very closely the crumpling sound made in walking over newly-fallen snow. These are the most common varieties.

More rarely the sound is not so characteristic; it may be more dry and shorter, and is said in some instances to resemble a sonorous râle: such cases, however, must be extremely rare. So also with the pleural rustlings described by certain authors as incident to the presence of chronic and extensive pleural thickening, and as somewhat similar to a subcrepitant râle; such sounds, it is true, are occasionally heard, but it is difficult to say whether they are of pleural or of pulmonary origin. These friction sounds are, moreover, superficial and give this impression to the ear. They differ

markedly from pulmonary and bronchial râles. Often they impart a fremitus to the hand laid upon the chest; and sometimes, indeed, the rub can be heard by the patient himself. Again, a friction sound is, as a rule, quite uninfluenced by cough; the latter does not cause it in any way to change its quality or location, as is often true of bronchial râles. A friction sound is local - at least it has a point of greatest intensity from which it is mot widely transmitted; a sonorous râle is often heard all over the chest. Having once heard a pleuritic rub, it can be recognised easily again: so that after all the above distinctions are of little service. The friction is somewhat variable as regards its duration; for it is often present at one examination and absent at the next,- or, on the other hand, either the same sound or newer ones may persist with remarkable intensity for many days after there is an entire disappearance of the pain and all other symptoms of the disease. In the majority of instances the friction is located over the lower half of the chest, particularly in the region of the nipple in front, and of the angle of the scapula behind; it may be heard over the upper front, but it is seldom indeed ever heard above the third or fourth rib. This is a remarkable fact; for pleurisy, as proven by adhesions, is common enough over the upper lobes. It is probable that a certain amount of expansion is required to effect the necessary separation of the agglutinated pleural surfaces, and where the respiratory excursion of the lung is greatest (that is below) this is only possible.

The DIAGNOSIS of dry pleurisy from intercostal neuralgia or pleurodynia is sometimes aided by the presence of fever; usually it must be based almost entirely upon the fact of friction being discovered. In pleurisy which is synchronous with the action of the heart, a friction sound is sometimes heard. It is due to the rubbing of the roughened pericardial against the pulmonary pleura, and is to be distinguished from ordinary pericardial friction by its limitation to the left border of the precordial region, and by its intensification at the height of inspiration.

II.- SERO-FIBRINOUS PLEURISY.

CLINICAL FEATURES.

Sero-fibrinous pleurisy is synonymous with pleurisy with effusion and subacute pleurisy. Its onset is somewhat sudden and violent, its early symptoms differing but little from many cases of the simple dry form, and there being no criterion by which a subsequent effusion can be predicted. Its principal symptoms are pain in the chest, dyspnoea, cough, and a very considerable amount of constitutional disturbance. There are often slight chilly sensations, which may persist for several days, but an initial rigor is seldom encountered.

In the vast majority of instances the first, and for several days the most prominent, symptom is PAIN in the side. It is usually sharp and lancinating from the very first; it may, however, begin as a simple feeling of soreness, which later becomes more acute and localised. In some cases it is so severe that it gives

rise to symptoms of threatening collapse. The pain is felt most commonly just outside the nipple in the fifth or sixth interspace; exceptionally it may be located beneath the sternum, under the clavicle, in the supra- or infraspinous fossa, or in the abdomen. Its source was at one time supposed to be the rubbing of the two pleural surfaces against each other; but the frequent occurrence of friction without pain, and in a different locality, contradicts this view. And many facts, as for example, the existence in pleurisy of painful points, seem to show that much of the pain at least is due to an involvement of the intercostal nerves; hence, possibly its existence in the exceptional localities just named. The pain is sometimes excited, and always increase, by pressure or by any movement which disturbs the parts, especially deep inspiration and cough. Its duration is extremely variable; it often ceases, or at least becomes much less severe, by the end of two or three days, and only in the rarest instances does it persist after the occurrence of effusion. Some refer this fact to the diminished respiratory movement which the fluid entails, and others to the presence of fluid between the inflamed pleural surfaces.

The subjects of pleurisy nearly always suffer from **DYSPNOEA**, but to a degree that varies in different cases. Due at first partly to the pain caused by full inspirations, and partly to the fever, its severity will be directly proportionate to that of these signs. Soon, however, another element is added, that of pulmonary retraction before the growing effusion, and consequent diminution of aërating surface; and later also interference with the circulation from actual pressure upon the heart and great vessels. It is quite common, therefore, as the effusion progresses to meet with a high degree of orthopnoea and cyanosis; the recumbent position becomes impossible, and the accessory muscles of respiration are all brought into play. But the degree of dyspnoea is often strikingly out of proportion to the amount of the fluid; in a very large effusion it may be slight even when the fever is high, while in a small effusion it may even amount to orthopnoea. These differences depend upon the previous condition of the lung and upon the general nutrition; a diseased lung may be made but little worse by retraction or even compression, and the susceptibility of the respiratory centre to diminished oxidation is largely dependent upon whether the patient is robust or has been for a long time weak and cachectic. For example, in the very young and the aged, and in victims of chronic nephritis and the like, but little dyspnoea may be provoked by the largest effusion. Again, an effusion which is rapidly produced is more apt to cause intense dyspnoea than when the exudation is one which is slowly formed; in the latter an opportunity is given for more effective adaptation to the new conditions. The duration of the breathlessness is coincident with that of the pleural exudate in the vast majority of cases, as a rule.

From the very onset of the affection the patient usually suffers from a troublesome **COUGH**. It is a short, dry, painful and ineffectual symptom, expectoration being very slight or absent. At first due to pleural irritation or a slight bronchitis (so Nothnagel

affirms), it after this changes its character, becomes more paroxysmal, and is often induced by changes of posture, as from the recumbent to the sitting; this is attributed by Peter to an irritation of the ends of the vagus caused by displacement of the fluid - an explanation, however, which is not accepted by Nothnagel and Fraentzel. Cough may perhaps result from re-expansion of the lung, as is often seen when aspirating, during the process of absorption of the exudate.

During the initial stage the POSTURE of the patient is the same as in dry pleurisy; if there is no orthopnoea, he either lies upon the sound side to avoid pressure, or in a semirotated position towards the affected side. As soon as any considerable effusion has developed, the posture changes; the respiratory function of the compressed lung being in complete abeyance, the patient lies upon the affected side in order to give freer play to the sound lung.

When the pleurisy is primary and acute, the CONSTITUTIONAL SYMPTOMS are, as a rule, marked. After a few hours, possibly of MALAISE, there is an abrupt rise of TEMPERATURE to 102. to 104. F., generally without chill, and attended by the usual headache, anorexia, furred tongue, muscular pains, and other concomitants of fever. The latter varies exceedingly in different cases. Most authorities give as more or less typical a steady continued fever of 102.-103., or even 104.F., for the first seven to ten days; it then becomes remittent, with gradually diminishing evening exacerbation, until at the end of the week it has fallen to the normal. But there is certainly frequent divergence from this type. The initial high temperature may almost immediately subside, or a slight hectic fever may continue until the effusion is entirely absorbed. As a rule, one is justified in suspecting that the inflammatory process is still persisting when hyperpyrexia is observed. The rise in temperature causes an increase in the frequency of the PULSE; but apart from this, it is apt to be small and hard. Netter says that these latter characteristics are due to pain, and disappear with the subsidence thereof; Fraentzel affirms that they become more noticeable as the effusion increases, and are due to direct interference with the return of venous blood to the heart; the view that this, rather than a diminished circulation of blood in the compressed lung, is the cause of these phenomena he regards as corroborated by the fact that after aspiration, although as yet the lung cannot possibly have expanded, the pulse becomes immediately full and soft. The URINE presents febrile characteristics. The chlorides are diminished at the outset, but when the effusion commences to subside they are present in great abundance,- at which time, too, the previous scantiness and high colour give place to polyuria and pallor, and often with marked suddenness.

In acute sero-fibrinous pleurisy the COURSE, though always uncertain, is not lacking in a certain tendency to a typical evolution. In at least a majority of cases the effusion increases steadily for a time; then for a few days it is stationary,- Lancereaux's "période d'etat",- and finally subsides, at first rapidly and then more slowly and steadily to complete reabsorption.

The exudative stage and that of absorption have

each an average DURATION of perhaps fifteen days; the période d'etat last usually from two to seven days, but it may, however, be wholly lacking. A case, therefore, of acute pleurisy with small or moderate effusion may be expected to last from four to six weeks, to which at least another month must be added for the complete absorption of false membranes, and an approximate return of the part to normal. Purely rheumatic cases are said to be much shorter; according to Netter, the effusion forms in a few hours, and in from two to five days may be wholly reabsorbed. On the other hand, very large effusions show a decided tendency to become chronic; for they seldom disappear in the above-mentioned period if left to themselves.

In the so-called LATENT FORM, the second type of sero-fibrinous effusion, the affection is of insidious onset and more chronic course. Its beginning is often entirely unnoticed by the patient, and he first comes under observation when an effusion of considerable size had developed. His chief complaint is of cough, or of shortness of breath, especially on exertion, or possibly of some pain or uneasiness in the side. There is more or less depression of the general health; appetite is impaired, strength is diminished, and there is usually a considerable degree of pallor. In some cases, particularly in children, these general symptoms are the only ones which have been noticed, and there is absolutely nothing to call attention to the chest. These latent forms are especially common at the extremes of life; in tuberculosis, in chronic affections of the heart and kidneys, and in individuals already weakened by other diseases. There are all possible degrees and varieties between the acute and latent forms of sero-fibrinous pleurisy. Many secondary pleurisies are, of course, overshadowed by the primary affection, and their symptoms accordingly pass unobserved. Again, a pleurisy of vigorous onset may be apparently recovered from, and yet a latent form of inflammatory process be left behind which continues its slow evolution. In all forms months, or even years, may elapse before the effusion is spontaneously absorbed, or, if it is artificially withdrawn, it may persistently reappear. Probably a large proportion of these latent and recurrent forms are tubercular. They may, however, be fully recovered from: or, more commonly, unless the patient does in the meantime from tuberculosis, there remains great fibroid thickening of the pleura, with subsequent retraction and often sclerotic processes in the lung itself - condition which tend to consecutive disease of the circulatory apparatus, and a steady impairment of the general health of the patient. Nevertheless he may not die of the disease before the lapse of several years.

PHYSICAL SIGNS.

The physical signs of sero-fibrinous pleurisy do not materially differ from those of the dry form until the fluid had developed in sufficient quantity for detection. The only sign of importance, namely, FRICTION, has already been described. But within a few hours from the onset of the disease the EFFUSION begins to form; in the experiments of Andral and Wintrich, with the injection of irritants into the pleural cavity of animals, the period varied from five to thirty hours. Still,

it is not until considerably later, perhaps from the second to the fifth day, that the effusion can usually be detected. The quantity of fluid which may gather before any physical signs are produced has been variously estimated by different observers, depending considerably upon the methods employed for this. It is usually placed at from three to five hundred cubic centimetres; but there is a probability that this amount is not infrequently an underestimation. For convenience of description the physical signs of effusion may be considered as occurring in a typical uncomplicated case without old adhesions or any marked pathological process in the lung. Furthermore, we may with advantage divide effusions according to their size into small, moderate, and large. In the small effusions the signs of exudation appear only behind; in the moderate form the pleural cavity is perhaps only half-full of fluid, and flatness appears over the lower front; in a large effusion the lung is compressed, the mediastinum and diaphragm are much displaced, and the thorax is nearly or quite filled with fluid.

Before the effusion has developed there is no change in the chest noticed on INSPECTION, and even when the effusion has been produced in only a small quantity this is true, except as regards a certain degree of diminution in the respiratory movement of the affected side; this is due, partly at least, to the pain. As the effusion increases, this respiratory immobility becomes greater, and finally all movement of the affected side is prevented when the chest becomes completely filled with the pleuritic exudate. The side upon which the effusion is located is manifestly larger than the other. The nipple and scapula are both farther removed from the median line, and the sternum also is often slightly deflected towards the affected side, as may be tested by a string carried from the sternal notch to the symphysis. The intercostal spaces are seen to be more or less obliterated, rarely perhaps to protude. The impulse of the heart's apex may be detected in an abnormal situation; or a noticeable tumour may be produced in the hypochondrium from sagging of the diaphragm or prominence of the dislocated liver. As hardly more than curiosities may be regarded the one or two reported instances of pointing of a sero-fibrinous effusion. In a case reported by Sahli, a tumour appeared under the clavicle, but did not result in perforation. In another case, reported by the same author, a sero-fibrinous effusion was evacuated by a cavity in the lung. Not a few authorities have attached considerable importance to MENSURATION in the diagnosis of fluid within the chest, but it appears to be of limited utility. The COMPARATIVE MEASUREMENT of the two sides seldom gives conclusive evidence, the difference usually being so slight as to be easily attributable to error; moreover, the normal difference of a fraction of an inch in the circumference of the two sides, usually in favour of the right, does not lessen the uncertainty of the result. On the other hand, as an indication of change in the quantity of fluid from day to day, repeated measurements of the whole circumference of the chest may be of service. Still, even here the results are not conclusive, as pointed out by Fraentzel, as effusion may be steadily

diminishing, and since the diaphragm is usually the first to feel the effects of absorption, the circumference of the chest may remain unchanged. PALPATION gives most valuable signs in inflammation of the pleural membrane. The most valuable of all the signs furnished by the sense of touch is the almost invariable diminution of vocal fremitus over that portion of the chest where the fluid is in immediate contact with the chest wall. It is hardly necessary to add that here, as elsewhere, the degree of fremitus, owing to the great variations in different individuals, can be determined bu carefully comparing corresponding areas on both sides of the chest. In a small effusion fremitus over the fluid is only diminished; in a moderate or large effusion it may be entirely absent. Few signs of effusion are more valuable than the absence of vocal fremitus. It is, however, by no means infallible. If there are numerous adhesions, or if the effusion is multilocular, fremitus is frequently unimpaired, and it may be present in an apparently uncomplicated case of small effusion. Over the lung itself fremitus is normal if the effusion is only small or moderate; the line of demarcation between the fluid and the lung may be quite sharply defined by testing the fremitus with a single finger moved slowly from below upwards. Owing to the solidified condition of the lung in the case of a large effusion, the fremitus is usually considerably increased over the pulmonary tissue. In the case of a large effusion also, palpation may disclose an increased sense of resistance in the intercostal spaces of the affected side. Certain Continental authorities speak of a"sense of fluctuation" which may be obtained by palpation with the two fingers in the same intercostal space; it is, however, admitted to be of rare occurrence. Mouisset further describes a "sensation de flot," called also by Tripper "fluctuation vibratoire," a sort of fremitus or vibratory sensation felt in the hand on applying it rather forcibly to the chest, or on laying one hand upon the chest in front and striking with the other behind. It can be appreciated only in a patient with chest walls that are thin and elastic, and over large and encapsulated effusions in such persons. Displacement of organs is another valuable sign afforded by palpation. In a large left-sided effusion the heart's impulse may be felt in the epigastrium,and also at times in the fourth and fifth intercostal spaces about an inch or so to the right of the sternum. In effusion upon the right side the impulse may be from one to inches or more outside the left mammillary line. In small effusions cardiac displacement is best shown by percussion. Dislocations of the liver or spleen, as produced by large effusions, are also most readily determined by palpation; either organ may project a varying distance from the ribs,or in extreme cases the diaphragm may sag downwards and appear in the hypochondrium as a large, prominent, and fluctuating tumour beneath which may be felt the liver on the right side. Oedema of the chest appears only exceptionally in sero-fibrinous effusions, and in a very mild degree; this,too, when present may be detected by palpation. Another valuable aid to diagnosis is afforded by PERCUSSION. A marked sense of resistance is imparted to the examining finger, and the percussion note is

absolutely flat when a sero-fibrinous effusion is in contact with the thoracic wall. Clinicians have always found an interesting subject for discussion in the shape of this flat area, particularly its upper border. Owing largely, no doubt, to the diversity of opinion which still prevails, most writer refuse to accord any very prominent place amongst the signs of pleurisy to the curve of the effusion. Up to the time of Damoiseau it was universally thought that the upper boundary of the flat area was horizontal. Damoiseau claimed that it was a parabola having its highest point at the angle of the scapula. The observations of Ellis, published in the later seventies, were somewhat to the same effect. He described a curve having its highest point in the axilla, but quite different in shape from a parabola, and named afterwards by Garland the "letter-of-S curve." Garland also devoted great attention to the physics of the subject; and his work on pneumodynamics represents the best that has been presented to the profession on the relation between a pleuritic effusion and the surrounding parts. The existence of the S curve, in all effusions except the larger ones, is affirmed by both Ellis and Garland. Little attention has been paid to the subject by German observers. Heitler described a curve very similar to that of Ellis. Fraentzel says nothing about the matter except regarding the very large effusions which nearly fill the chest. Wintrich holds that the line is not horizontal, but descends towards the ground at a more or less acute angle. Leichtenstern and Ferber think it depends upon the posture of the patient early in the disease. Gerhardt holds the same view. Weil is more explicit; he finds that small and moderate effusions usually present a curve with an upward convexity which is highest at the spine. He adds, however, the following confirmation of the opinion expressed by Ellis: "In the other cases I was able to convince myself most emphatically that the exudation occupied almost the whole lateral region of the thorax; while in front it was scarcely perceptible and behind did not reach as high as the middle axillary line." Since this statement covers the really important points of the S curve, it is difficult to understand his assertion, made farther on, that he has never been able to convince himself of the reality of the S curve. The original description of Damoiseau is accepted by Netter. I find it very difficult to explain these differences of opinion. Varied methods of percussion may account for them in part. Undoubtedly the principal reason is to be found in the fact,- for me at least assured,- that these curves vary with the quantity of the fluid. This does not, however, impair in any way their diagnostic value. Each curve is quite constant and characteristic in its own particular field; and I venture to affirm that, in diagnostic value and utility, no other sign of effusion is to be compared with this. The curve in question represents the upper border of absolute flatness; and this can only be determined by light percussion. The lung above the fluid is not wholly resonant, especially behind, and the stroke must be exceedingly light and delicate to differentiate between the absolute flatness below this and pulmonary dulness. The presence of a slight, imperfectly defined dulness at

the extreme base behind, or of a diminished respiratory excursion of the posterior border of the lung, may suggest the commencement of effusion before enough fluid has accumulated to occasion a flat note.

Regarding the dimensions of effusions, and beginning with a **SMALL EFFUSION**, it may be mentioned here that the first positive evidence of the presence of fluid in the pleural cavity is a slight degree of dulness at the extreme base of the chest behind. This zone of dulness may be but an inch or two in width, and extends laterally from the spine for a varying distance towards the axilla. It is often misinterpreted or overlooked, and is recognised only by those who habitually define by careful percussion the lower margin of the lung on both sides behind. The position of these lower margins varies considerably in different individuals according as the lungs are absolutely normal or, as is often the case, more or less emphysematous; and it is only by comparing the two sides,- whereby it is to be borne in mind that the left is normally a little lower than the right,- that a slight unilateral dulness will be readily noticed. Over this dull area respiration is slightly diminished,and immediately above it friction may still be heard. Some foreign writers believe that fluid may be detected even before the appearance of the dulness.Weil says that, owing to the presence of fluid in the complementary space, the normal respiratory excursion of the lung into this space is found to be absent. Gerhardt thinks he has often discovered fluid by causing the patient to assume the knee-elbow position, with moderate inclination of the body towards the affected side; the fluid, he thinks, then gravitates to the axillary region, in the lower part of which it causes a perceptible dulness; it is, however, generally held that a small effusion is immovable. These basal signs become more pronounced as the fluid increases in quantity. The dulness soon changes to absolute flatness, which can be easily and sharply defined on percussion. This flat area has a characteristic and constant shape.Occupying the right angle between the spine and the horizontal base of the lung, it is bounded above by a curved line with upward convexity, which, extending outward from the spine, drops, at first gradually and then more abruptly, so as to reach the base at a point near the posterior axillary line. This curve has been termed the "convex curve of small effusion." At first the zone is narrow, not more than two or three inches in width,and the drop is early. As the effusion increases the zone broadens and the drop is farther forward, sometimes reaching the middle or even the anterior axillary line. This is not, however, always the case; it would seem that posture is not entirely without influence upon the shape of this flat area; and not infrequently this zone may be five to six inches in width and yet not reach farther forward than a line drawn down through the middle of the axilla. The vocal fremitus is much diminished or absent over this zone of flatness. Respiration is still usually heard, though also much diminished in intensity,and is sometimes accompanied by fine moist râles, which undoubtedly originate in the lung.Friction is also sometimes heard over the flat area. The vocal sounds are slightly distant and diffused; bronchophony

or aegophony and bronchial breathing are heard over an effusion of this size only when it is complicated by consolidation of the lung. There is little, if any, departure from the normal condition, with the exception that above this effusion respiration is perhaps slightly diminished for a moderate distance. Displacement of the heart is seldom or never observed.

In the case of a MODERATE EFFUSION a height of five or six inches having been attained by an accumulating liquid, any further increase is forward and upwards into the axilla; at the spine it makes a temporary halt. We find, therefore, in a moderate effusion a peculiar and characteristic curve of flatness, which, as stated, was first described by Ellis, and which is now well-known as the letter-of-S curve. Beginning at the spine some five or six inches above the base of the lung, it extends at first outwards, and then sharply across the scapula to the upper part of the axilla; from here it may drop abruptly to the base in front near the apex of the heart, or, if the effusion is larger, it may follow approximately the third or fourth rib to the sternum. Frequently it rises so high that it cannot be traced across the axilla, but loses itself in the shoulder. Various S curves may be diagramatically respresented by any interested investigator. The S of the curve is more pronounced as to character in an effusion of medium size; as the quantity of the fluid grows still larger, the curve straightens and approaches more closely the "concave" curve of larger effusion. This S curve is the only one likely to be encountered in an uncomplicated effusion of moderate size,whether recent or of long duration. It is seldom possible to follow carefully the change from the "convex" to the "letter-S"curve,owing to the rapidity with which it takes place; on one day the former may be found,on the following the latter. Attention to the following points will serve to facilitate the percussion of the S curve,which might,indeed, be considered as comparatively easy had not so many foreign observers denied its existence: The first point to be remembered is that the lung above a moderate effusion gives a resonance which differs according as percussion is made in front or behind. Posteriorly it is decidedly dull. This is more marked as the line of fluid is approached, and is especially noticeable in the space between the S curve and the spine. Garland calls this space the"dull triangle," and recommends that it be cleared somewhat by means of a few deep inspirations before attempting to mark out the curve. This is undoubtedly a valuable suggestion, though I have never found it necessary, and it should not lead to the inference that this curve is often obscure or difficult to detect. In front resonance over the lung is markedly tympanitic; its pitch is low at first, but becomes higher as the effusion increases. Both Fraentzel and Weil regard the appearance of high-pitched tympany as indicative of commencing compression. This tympanitic resonance over the retracted lung of pleuritic effusion is usually termed the "bruit Skodique",after Skoda, and is probably due to the diminished tension of the alveolar walls. On the other hand, diminution in volume means increased density, and therefore higher pitch; hence,as the lung begins to undergo actual compression by the

fluid, there is a gradual change from a low to a high tympanitic note. The only evidence of displacement in the case of a moderate effusion is to be found in connection with the heart, and this only when the effusion is in the left pleural cavity. Any movement of the heart towards the right is extremely easy to detect. Normally the right border of the heart towards the right is represented by a perpendicular line extending from the third rib to the liver just inside the left border of the sternum. The lower half of the sternum is normally resonant, at least as resonant as its upper half, with which it should always be compared. Any displacement of the heart towards the right is at once attended by the appearance of dulness in this cardiohepatic angle; and because of the sharp differentiation between flatness and full resonance which is here possible, any encroachment upon the sternum is very easily detected. This slight displacement of the heart is a very important confirmatory sign of left-sided effusion. Enlargement of the right heart, or a pericardial effusion will, of course, produce a similar result, and both must therefore be excluded. As the precordia from the fifth year to beyonf puberty in children extends normally to beyond the right margin of the breast-bone, the sign obviously has no value.

The shape in the case of a LARGE EFFUSION is of less diagnostic significance. The curve is hardly so characteristic, and in the marked displacement of the organs we have a more absolute sign. Again, this line is not always so easily defined, particularly behind where the resonance over the compressed lung is most dull. Still, the curve of large effusion is very constant. Beginning at the junction of the second or third rib with the sternum, it passes outwards and upwards over the clavicle and shoulder, then downwards and inwards to the fifth or sixth dorsal vertebra. It has an upward concavity; and, in contradistinction to those alreadydescribed, has been termed the "concave curve of large effusion." There is still a tympanitic resonance of high pitch in front over the compressed lung. Behind it is very dull, sometimes quite flat; indeed, from the posterior wall of the chest the lung may be wholly separated from the effusion. Over the compressed lung in front we may note the occasional occurrence of several varieties of resonance. Just below the inner end of the clavicle the note is often tympanitic, even when this quality has disappeared below, and when the rest of the lung is quite dull or flat. It is then called the "Williams' tracheal tone," and originates in the large bronchi or trachea, the vibrations of which are transmitted through the compressed lung. This tone has a high pitch which changes with the opening or closing of the mouth; it can be detected only by strong percussion, and is found only in large effusions. In rare cases - probably due to some local constriction of the bronchus - it has more or less metallic quality or "cracked-metal resonance." Of all the signs of large effusion that can be evidenced by percussion, I attach perhaps the greatest importance to that of dislocation of the organs. So far as the heart is concerned, if it be free to yield to the pressure of fluid, it will be found displaced to the right or left as the case may be. This disloca-

tion is far more pronounced when towards the right. I have already shown that even in moderate effusions upon the left there is a movement of the heart towards the opposite side, as indicated by the appearance of dulness over the lower half of the sternum. As the fluid increases the upper and right border of this dulness moves still farther outwards, and the dulness becomes more complete. Finally, in very large effusions the precordial area may lie wholly to the right of the median line, and present an outline very similar to that which normally exists upon the left. It has both a zone of relative dulness and one of absolute flatness. The latter, continuous towards the left with the effusion and below with the liver, is bounded above and to the right by a curved line of upward convexity, which extends from the costosternal articulation of the fourth rib outwards and downwards to the liver a little inside the mammary line. Outside of this flat area is the zone of relative dulness, about one inch in width. In right-sided effusion, the outer borders of both absolute and relative cardiac dulness are simply displaced towards the left - in extreme cases so as to reach the anterior axillary line; the upper border remains at its normal level. These dislocations have an inferior diagnostic value, for the reason that they are neither so pronounced nor so early perceptible as those towards the right. The mediastinum, with the heart, is also crowded over towards the sound side. This displacement can only become plainly evident when the fluid has risen above the level of the fourth rib in front and the resonance of the lung has become quite dull, for then only is there a distinct of demarcation between the sound lung and the diminished resonance or flatness of the opposite side. In extreme cases the mediastinum may be found an inch or more beyond the sternal border, though it is usually just opposite it. One may follow, with more or less accuracy, the downward displacement of the diaphragm on the left side; on the right, it can only be inferred from the position of the lower margin of the liver. Weil says that in small effusions, when the weight of fluid presses chiefly upon the posterior regions of the diaphragm, he has often detected an elevation of this lower hepatic margin, the upper boundary remaining unchanged - a condition which he ascribes to a tilting of the organ upon its transverse axis. In all large effusions the liver is depressed in toto, and its lower margin may be found even at a level with the umbilicus. At the same time there is usually a lateral tilting upon its anteroposterior axis, so that the left lobe is relatively higher than the right, and the lower margin has an unusually diagonal course. Of course, the upper hepatic boundary is blended with the flatness of the fluid in the case of large effusions. The fact that the descent of the diaphragm on the left can be more closely traced obtains only in front, and here in a small area known as Traube's space. This space is bounded below by the free border of the ribs, above by the left lobe of the liver, the pulmonary margin, and the spleen. The underlying stomach and colon, when empty, give this area normally a tympanitic resonance, which presents a sharp contrast to the non-tympanitic resonance above, or still more to the flatness of effusion. It is therefore easy

to follow the progressive drop of the latter, and the narrowing of this space which begins when the effusion has reached a considerable size. This space may eventually become entirely obliterated; or the flatness may even project beyond the ribs in question in cases, mostly purulent, in which the diaphragm actually sags. Traube, and following him Fraentzel, attributed a very great diagnostic importance to this space and the signs it affords. Weil, however, very justly observes that these signs are late, and therefore of no assistance in small or moderate effusions where such aid is most needed - a large effusion presenting, in general, no special difficulty in diagnosis. Furthermore, if the stomach or colon be full this space is normally dull. When the diaphragm is depressed the spleen is displaced forwards and downwards; but since its flatness becomes blended with that of of the fluid, this can seldom be determined by percussion. A large effusion may have its effects upon the opposite lung. The very considerable displacement of the mediastinum, already described, gives the lung together with the diaphragm of the unaffected side an opportunity to retract. The resonance, therefore, may be markedly tympanitic over the whole opposite front; and, from the same cause, the liver may be more or less depressed if the effusion is one on the left side. There has been considerable disputation about the question as to the mobility of a pleuritic effusion. While there is still some difference of opinion, most authors agree that very large effusions do show a slight change in position after the lapse of several minutes, as well as that the extent of this change seldom amounts to more than a single intercostal space. As to small effusions, statements are few. I have never been able to detect the slightest change in their position. Gerhardt thinks that these small effusions are even more movable than the large ones, and that an early effusion may sometimes be detected by a suspicious dulness which appears in the axillary region when the patient assumes the knee-elbow position with inclination towards the affected side.

The auscultatory phenomena in the case of a LARGE EFFUSION vary greatly with the degree of pulmonary compression. In general, the respiratory murmur will be found to be diminished wherever the fluid of a pleural effusion is interposed between the ear and the lung. In some cases it is totally absent, though this can hardly be considered a common occurrence. The cause of this diminished respiration is, on the one hand, the great distance of the lung from the ear, and, on the other hand, the feeble expansion of the lung itself. The quality of respiration, as found over the fluid, is approximately vesicular in both small and moderate effusions, or, in other words, so long as the lung is not compressed. When actual compression begins, and the entrance of air into the pulmonary vesicles becomes impeded, the quality of the respiratory sounds changes; it becomes at first bronchovesicular, and finally bronchial after the tubes alone remain pervious. Hence, over a large effusion vesicular respiration is never heard; if any at all is perceived, it is beonchial, and usually by careful auscultation a very faint and distant respiratory sound can also be detected. The latter becomes

louder the closer the lung is approached, and it is also bronchial in character. Nevertheless, there are noteworthy exceptions to this rule. One of the most frequent of these is to hear loud bronchial respiration clear to the base of a large effusion - in children especially, a very common occurrence. Less common are the instances in which respiration is bronchial over a small effusion, as, for instance, when three or four inches would cover the width of the posterior zone of flatness. When, probably from compression or other cause, the bronchi themselves are no longer open, one may in still other cases observe a complete silence over the whole chest from top to bottom. In small effusions the respiration over the lung is, though diminished, fairly constant and of vesicular quality. In moderate effusion it is comparatively normal in front; behind it is distant and indistinct, often called "intermediate." In large effusions it is, as a rule, markedly bronchial, exceptionally quite absent. In certain instances also of the latter, it may be even amphoric; here only can we suppose a constriction of the main bronchus, as in the case of cracked-metal resonance. For the most part the voice sounds correspond to the respiratory murmur, presenting the same characteristics as to quality and intensity. For example, over a small effusion the voice becomes more distant the stethescope crosses the line of fluid. In a moderate effusion this change is still more marked, the voice is still more distant, and perhaps rather plaintive sheepingly in character. In a large effusion there is, as a rule, bronchophony over the compressed lung, and either distant, or rarely loud, bronchophony over the fluid. If respiration is totally absent, the voice sounds are also faint and never distinct. Occasionally we come across a variety of bronchophony which has been supposed to have a distinct and deep significance in the diagnosis of effusion, and to which Laennec first gave the name of aegophony. This sound is high-pitched and has a bleating, quavering or plaintive quality; as Laennec says, it has more the character of an echo than of the voice itself. It is far from being a constant sign of effusion, and is generally heard only in certain phases of its development - oftenest perhaps when compression has begun, but is not excessive. Besides being inconstant, it is not even pathognomonic of effusion, being also heard at times over a consolidated lung. It is a sign of no great clinical importance, though of very great clinical interest. On asking the patient to whisper, his voice is transmitted through a serous effusion with great distinctness, just as if the words were actually whispered into the ear of the listener. This "aphonic pectoriloquy" is often called Bacelli's sign, this author having laid particular stress upon it as distinctive of a simple serous exudate. It is, however, now known to be neither constant in the latter nor peculiar to it. Its diagnostic value is therefore small; and it is also found, though rarely, in empyema, especially in pneumonia, and very often in the case of cavities in the substance of the lung. As a sign of both dry and sero-fibrinous pleurisy, friction has already been mentioned. It usually ceases with the appearance of the fluid, though it may exceptionally persist along its border from continued activity of the inflammatory process. In very rare instances friction may be heard directly over a small

effusion, as is affirmed by Beck, and has also occurred in the practice of others in cases in which the diagnosis was confirmed by puncture. A not inffequent variety of friction is that which Wintrich has described as pleuropericardial; it is synchronous with the heart's action, and is produced by friction of the pleural covering of the pericardium against that of the adjacent lung. The presence or absence of pleural friction in its ordinary form, and its usual location at the extreme left border of the precordia, will serve to distinguish it from the friction sound due to the presence of pericarditis.

Finally, we may briefly consider here some of the physical signs found in certain ATYPICAL FORMS and resulting conditions. The question as to the mobility of a pleural effusion has been as fully entered into as its importance demands. In the case even of a large pleural effusion, its reabsorption may be complete. Its seems supererogatory to again describe the different signs which mark the various stages of the process, since they all reappear in reverse order, but in character precisely similar to those above given. First, bronchial respiration appears, which becomes more and more vesicular and less distant, until finally the full vesicular murmur is restored. So with the sounds of the voice. The line of flatness gradually falls, passing through the same varieties of curve as its ascent. Heart, mediastinum and diaphragm again return by a succession of gradual changes to their former positions. One of the special signs of reabsorption is the appearance of friction of an intensity and extent such as are present at no other stage. It is also common to hear a fine crackling over the whole lung in front; the explanation of Traube that this râle is produced by the forcible entrance of air into the collapsed pulmonary alveoli may be probably accepted. It has been affirmed by certain authors that the effect of absorption is first felt by the diaphragm, then by the lung, and finally by the heart; the latter may remain permanently fixed in its abnormal position, this being especially apt to occur in left-sided effusions. When once thoroughly established, the progress of reabsorption is not difficult to follow. Nevertheless, it is by no means easy to determine just where it begins; and yet this is of the greatest importance as regards treatment. Weil calls attention to the fact that it may be illusory to depend upon percussion alone, particularly of the upper border of flatness. This maydrop,- as for example, from yielding of the diaphragm,- and yet the effusion be still increasing. On the other hand, the level of the fluid may remain absolutely unchanged and still a marked absorption have taken place, with corresponding return of diaphragm and mediastinum and re-expansion of the lung; as Weil says, often one sees no change whatever in the level of the fluid after the aspiration of a considerable quantity. Even if the fluid does sink, the presence of a thick deposit of lymph may cause the percussion note to remain unaltered. Mensuration is still less reliable. There is, in short, no positive sign of reabsorption, particularly of a large effusion

However, large effusions are at the present time rarely left to nature; and in small and even moderate

effusions it is nearly always found that careful percussion of the upper line of flatness behind is a reasonably safe guide; there is here so little displacement of organs that s diminution in the volume of fluid can hardly fail to show itself by a lessened area of flatness. In large effusions with marked displacements, a conclusion can only be reached by careful attention to details - such as, in addition to the fluid level, an increased width of Traube's space, a slight movement of the heart, or a rise of the liver. It is here of the utmost service to make a careful marking of the percussion outlines from day to day. A slight dulness with diminished resistance may persist, at the extreme base of the chest behind, for quite a long time after the effusion has been completely absorbed. The presence of a residue of fibrinous clumps in the lowest portions of the pleural cavity, the absorption of which may be extremely slow, is suggested by this.

In the case of fibroid thickening of the pleural membrane with consequent retraction of the chest, in addition to the marked evidences of retraction and diminished circumference of the thorax to be observed on mensuration and inspection, the percussion note over the lower portion, sometimes the whole, of the affected side is nearly or quite flat. This flat area usually is poorly defined above, and shades off gradually into a fair pulmonary resonance. Respiration below is very faint, and the vocal sounds diminished; above, they vary according to the more or less healthy condition of the lung. Fremitus, on the contrary, is but little, if at all, affected by the pleural thickening.

In the case of encapsulated effusions there is, of course, no typical curve; and, as a rule, they produce no marked or typical displacements. Other signs are the same as those of ordinary effusion, except that they are apt to be less pronounced. In those multilocular effusions which develop in the case of old costo-pulmonary adhesions, fremitus is said to be often plainly perceptible. Again, adhesions may prevent the usual retraction of the lung towards its hilus, and it may then be found at the base or in a lateral region of the thorax; here, of course, there may be peculiar modifications of the percussion outlines.

III.- PURULENT PLEURISY.

CLINICAL FEATURES.

The symptoms of purulent pleurisy (syn.: empyema; pyothorax; purulent pleuritis; suppurative pleurisy), which is a purulent inflammation of the pleural membrane, vary according to the cause, and are by no means constant. The clinical history of the condition is not typical. Like sero-fibrinous pleurisy, it may present all possible variations between acuteness and chronicity, between violence of onset and absolute latency. At one extreme we have the complex of symptoms which Fraentzel has termed "pleuritis acutissima". Beginning with severe rigor, there is a rapid rise of temperature to 104. or 105. F., severe pain in the side, and intense dyspnoea. The exudation, which is purulent from the outset, appears early, and rapidly becomes voluminous; it is often putrid. The general condition is

markedly affected from the commencement: there are weakness and an equally great depression, rapid emaciation, dry tongue and sordes, tendency to delirium, rapid and feeble pulse, and, in short, all the concomitants of the typhoid state. A fatal result may occur at the end of a week, though such fulminant cases are exceptional. As opposed to this pleuritis acutissima we find, at the other extreme, cases of empyema whose onset is most insidious, and whose course is absolutely afebrile. While, however, a general latent course and onset are common enough, it is at least very unusual for an empyema to have no pyrexia at all in association with its evolution. In the vast majority of instances empyemas occupy an intermediate position between these extremes. Their symptoms are either marked at first by the primary affection, or the disease develops suddenly as a typical sero-fibrinous pleurisy with moderate fever, accompanied by pain and dyspnoea. But as the condition progresses the temperature shows a tendency to fall. On the contrary, at the end of a variable period, perhaps ten days or a fortnight, it gradually assumes the hectic type, often with chilly sensations, more rarely with repeated rigors. This septic condition results in a progressive, though sometimes gradual, emaciation and loss of strength. The face becomes extremely pale, and the steadily increasing dyspnoea is often out of proportion to the quantity of fluid. Cough is usually troublesome, of a dry character, and not necessarily the result of any pulmonary complications; in case of rupture into the lung it may, of course, be greatly exaggerated, with either sudden evacuation of a considerable quantity of pus or a more protracted purulent expectoration. Pronounced clubbing of the fingers develops in older cases, sometimes even in those of a few months' duration; so also with oedema of the lower extremities, generally associated with an albuminous urine. Finally, if there be no operative interference or spontaneous evacuation, the patient succombs to some of the complications hereafter to be described, to secondary waxy affections, or to exhaustion of the vital forces.

Symptoms of Varieties.

Having thus indicated in a general way the symptoms of empyema, we may here note the main clinical characteristics, though still imperfectly established, of the different bacteriological varieties of the disease. In this direction the arduous researches of Netter deserve the highest credit. Our narrative will include the streptococcus form, the pneumococcus form, the tubercular form, with some account of the foetid and putrid forms, and a short note on miscellaneous varieties.

It often happens that we find the STREPTOCOCCUS FORM of primary origination, or, more strictly speaking, it has not been preceded by any recognisable affection. This was true in sixteen of Netter's fifty-six cases. When thus primary it is apt to commence with a rigor and to show a very high range of temperature from the start. The form above described as pleuritis acutissima is probably in most instances streptococcal, though it is not to be supposed that all primary cases are thus fulminant. The form may be exceptionally wholly latent in onset and course, these differences being apparently

dependent on a varying virulence of the microbe. In general, however, it seems that streptococcus empyema tends to the production of a high and irregular fever, with general symptoms of the typhoidal type. Plainly secondary forms, such as may attend, for example, puerperal peritonitis, gangrene of the lungs, pyaemia, and the like, do not, of course, present any characteristic clinical features.

There are also more or less distinctive local phenomena to be observed in connection with streptococcus empyema. A circumscribed oedema of the thoracic wall, varying from a slight pale or rosy puffiness to a pronounced doughy swelling which pits on pressure, is particularly frequent in this form. The axillary glands are often enlarged. Exceptionally it gives rise to metastatic processes, among which cerebral abscess, with resulting paralysis and convulsions, appears to be relatively most common. Encapsulation of the exudate is not so frequent as in the pneumococcus form, nor is spontaneous evacuation of the pus through the lung or chest wall. The pus of streptococcus empyema is, in general, of but moderate density. Ordinarily, the fluid obtained on exploratory puncture is quite opaque, of yellowish tinge, and on standing deposits a pulverulent sediment in considerable quantity. Often, however, the fluid is but slightly cloudy, and may even be transparent; an intrapleural sedimentation has taken place, and the needle has entered the supernatent layer of serum. It is evident that in such cases it is quite possible to make a mistake in forming an opinion as to the nature of the liquid.

The PNEUMOCOCCUS FORM may be apparently primary, or may be a sequel of croupous pneumonia, sometimes also of bronchopneumonia. Undoubtedly the secondary form is far the more common of the two, although the antecedent pneumonia is not always recognisable. Netter, in fifty-three cases of pneumococcus empyema, obtained a history of pneumonia in only nineteen; however, twenty-one of these cases were in children, in whom slight forms of the disease often pass unnoticed. The primary forms may, it seems, begin with much the same complex of symptoms as a frank pneumonia. There may be rigor, pain in the side, cough, and a steady continuance of the same for from six to eight days, after which the constitutional symptoms are less prominent. Such cases have been reported by Washbourne (Brit. Med. Jour.): in one of these a post-mortem examination on the sixth day of the disease showed an abundant purulent effusion containing pneumococci without pulmonary lesion. Other primary cases may have no characteristic course. Secondary forms also vary greatly in onset and development. A metapneumonic empyema may precede the pneumonic crisis, or it may not appear for two months after the primary affection: usually there is an interval of apyrexia of two to four weeks' duration between the pneumonia and the consecutive effusion. With the latter the temperature again gradually rises, and soon a daily continuance becomes established. Netter says that, as a rule, the afternoon exacerbations vary from 102. to 103. F., and that the morning remissions are not usually pronounced. Exceptionally fever may be surprisingly slight or even wanting. Renvers (Char. Annal., 1889) reports two

cases, in one of which, after a seven days' interval of complete apyrexia, pus was aspirated on the ninth day; in the second day an empyema developed immediately after the pneumonic crisis, but the temperature nevertheless continued normal for seventeen days. Other symptoms of the pleuritic affection are slight. Pain is often absent, and dyspnoea appears only as the effusion becomes large. Some pallor and a moderate tendency to progressive weakness and emaciation are generally observed.

Nevertheless, despite the irregularity of its evolution, this form of purulent pleurisy has quite a characteristic physiognomy. In the first place, oedema of the chest wall is decidedly exceptional; it was present in none of Netter's fifty- three cases, and the same observer could find but three instances reported in the literature. And yet, on the other hand, spontaneous evacuation is surprisingly frequent in this form. Netter found that it had occurred in twenty-five per cent. of all reported cases, and in his own series the proportion was as high as forty per cent.,- certainly a very remarkable fact. This evacuation is oftenest through the lungs, though only exceptionally attended by the production of pneumothorax. Less often there is rupture through an intercostal space, and even this event is considerably more common here than in any other variety of empyema. Furthermore, there is noticeable in this form a decided tendency to encapsulation; many of the cases of interlobular, diaphragmatic, and other local empyemas are pneumococcal. Very important and distinctive is the character of the pus. It is, as a rule, of a dense creamy consistency, rich in fibrin, and therefore extremely viscid. Its colour is greenish- yellow, the shade of green being usually so pronounced as to make it a special diagnostic feature. The pus is also rich in fibrinous clumps and flocculi. Finally, pneumococcus empyema is of peculiarly benign course and progmosis. Most cases end in complete recovery, and it is unquestionably in this form that so many favourable results have followed the milder forms of operative treatment. Hence also the favourable course of most empyemas in children; and the complete accord between this long-established clinical fact and the more recent evidence of bacteriology is certainly remarkable.

The TUBERCULAR FORM may perhaps occasionally be acute; certainly it is more usual to find that its characteristic course is chronic, of latent type and insidious development. It may apparently be purulent from the outset, or, what is probably the rule, it commences as a sero-fibrinous pleurisy, the exudate of which repeatedly recurs after withdrawal, and eventually, without general symptoms of infection, acquires a purulent character. Unquestionably many of the cases in which aspiration has incurred the suspicion of having changed a simple into a purulent effusion come under this category. The pus in tubercular empyema is usually thin, grayish, pulverulent, poor in leucocytes, and not infrequently chyliform or fatty. Sometimes it perforates the thoracic wall, and appears externally as a cold abscess which in rare instances may pulsate synchronously with the heart. The form is not infrequently complicated with pneumothorax. Its diagnosis may occasionally be made by the discovery of the tubercle bacillus; and its

presence if always to be considered probable when the pus contains no pathogenic germs or only the staphylococcus. The general condition in tubercular empyema, when uncomplicated by advanced phthisis or by the presence also of pyogenic germs, may remain good for an indefinite period, and months or even years may elapse before health becomes seriously impaired and the disease advances towards a fatal termination. It is, however, not to be forgotten that both streptococcus and pneumococcus forms may, and do frequently, occur as secondary affections in connection with tuberculosis of the lungs, and that it is then possible for recovery from the empyema then to occur.

The invasion of the pleural cavity by saprophytic germs is responsible for the occurrence of FOETID and PUTRID FORMS of empyema. Most frequently the source of infection is some form of cortical pulmonary gangrene, which, however, may not necessarily have opened into the pleura. It is evident, therefore, that a putrid empyema may originate as such - may be "putride d'emblée," as it is often termed - and Netter believes that the great majority of cases do begin in this way. The onset of the disease is then extremely violent. There is an initial rigor, followed by an immediate rise of temperature to a very high degree. Pain in the side is of extreme and unusual severity. The tongue soon becomes dry and brown, prostration is very marked, and, in short, the patient develops a condition of profound sepsis. Other cases, again, are less stormy in origin, particularly those forms which develop out of an originally serofibrinous or simply purulent exudate. This is most likely to happen when the effusion has been of long standing, and for this reason, as well as others, tubercular effusions show an especial tendency to this change. Putrid empyema is very often complicated with pneumothorax.

Despite the fact that there is nothing absolutely characteristic about the evolution of putrid empyema, there are certain things which justify a suspicion of its presence. Fever shows a tendency to a high range, and the daily oscillations are likely to be very great. Occasionally a foetid expectoration is met with even when there is no direct communication with the bronchi - a phenomenon analogous to the faecal odour of abdominal abscess, which is simply contiguous to the large intestine; in case of rupture into the lung there may of course be continuous evacuation of large quantities of stinking pus. The most characteristic feature of putrid empyema is the constitutional condition. As a rule, there is early and pronounced development of sepsis. The tongue is brown and parched; there are abundant sordes, great weakness and depression, stupor, and marked tendency to delirium. This same condition may, it is true, accompany the streptococcus form, but it is then exceptional, here the rule. The fluid withdrawn on exploratory puncture may be simply foetid, or it may have the almost unbearable odour of gangrene. Sometimes such a pus is thick and creamy, but usually it is thin and sanious, its colour varying between a yellowish-gray and the different shades of brown. On standing it deposits a sediment which is usually powdery and of moderate quantity. This sedimentation may be intramural, and the syringe may therefore, in exceptional

cases, aspirate an almost transparent serum. Its microscopical constituents are white and red corpuscles, varied cellular débris, crystals of fat acid and cholesterine, fat globules, and microbes. The putrid character of the pus may disappear in a very few days after the case has been operated upon.

There are MISCELLANEOUS FORMS of empyema which have been too little studied and are too infrequent to make any attempt at characterisation possible. Those containe ing solely the TYPHOID BACILLUS have usually proven benign in course. PURE STAPHYLOCOCCUS FORMS seem, if the life of the patient is sufficiently prolonged, to pass into the tubercular.

PHYSICAL SIGNS.

In a general way, the physical signs of purulent pleurisy are those of the sero-fibrinous variety already described. The character of the fluid is absolutely an indifferent factor as regards its effect upon auscultation and percussion. Bacelli, it is true, thought that he had discovered a differential sign of great value in the non-transmission of the whispered voice through a purulent effusion; but this may also be the case in both serous and haemorrhagic forms, and excpetions are so frequent that the sign is now generally admitted to be unreliable. Displacement in empyema is, on the whole, apt to be more pronounced than in sero-fibrinous pleurisy, and it is chiefly in the former that instances of enormous displacement and bulging downwards of the diaphragm, such as to produce prominence of the hypogastrium and a palpable fluctuating tumour, have been observed. I have already sufficiently described the local oedemas and the various qualities of the pus of purulent pleurisy.

The three forms of pleurisy described above are those most usually encountered; there are, however, certain special varieties of pleural inflammation which now call for consideration:

(1) DIAPHRAGMATIC PLEURISY

CLINICAL FEATURES.

A strange complexus of symptoms is sometimes observed in connection with an acute inflammation limited to that portion of the pleura which covers the diaphragm and under surface of the lung. The variety is not common. It may be secondary to contiguous abdominal affections or it may be primary, and, in general, subject to the same causative influences as other pleurisies. The dry form is exceptional; most cases are accompanied by effusion of either sero-fibrinous or, more rarely, purulent character. The onset of the disease is usually brusque. It may begin with a rigor, and, as a rule, the febrile movement is pronounced, frequently 103. to 104. F. The initial pain is extremely severe; it is in most cases referred to the hypochondrium, but may be felt along the costophrenic attachments or low down in the back. The face is anxious, the pulse rapid and small, and the dyspnoea often excessive. The characteristic physiognomy of this form of pleurisy is, however, chiefly due to the great tenderness of the inflamed diaphragm which the patient tries in every way to immobilise. To this end he may sit slightly bent with hands pressed against the sides, or he may take the semi-recumbent position with elevated knees. Respiration is

rapid, costal, superficial. The abdominal wall, especially on the affected side, is tense and its muscles are firmly contracted. The abdomen is extremely sensitive to pressure. Other tender points are also to be found along the course of the phrenic nerve, especially between the attachments of the sterno-cleido-mastoid and in the interspaces along the sternal margin; also over the costo-diaphragmatic attachments, and particularly at a point which lies in the intersection of two lines: one a prolongation of the right sternal border, and the other drawn horizontally at the level of the osseous portion of the tenth rib. These tender points are the result of a slight neuritis of the phrenic nerve, which may persist after the pleural inflammation has disappeared. Pain is also increased by cough, by the hiccough which is occasionally a troublesome symptom, and even by all attempts at speaking. Vomiting, though not constant, is a frequent and important symptom; it not only greatly aggravates the pain, but it often proves a very misleading feature in diagnosis. The bowels are usually constipated. In the graver forms delirium is frequent, and is apt to be a precursor of fatal coma.

PHYSICAL SIGNS.

Physical signs characteristic of pleurisy are usually lacking. Owing to the immobility of the diaphragm the respiratory murmur at the base of the chest is deficient; sometimes friction appears in the same region, or, in case of effusion, a zone of flatness with some downward displacement of the spleen or liver.

DIAGNOSIS.

The resemblance to peritonitis and other grave abdominal affections makes the diagnosis of diaphragmatic pleurisy of especial interest. The violent onset, anxious countenance, rapid pulse, vomiting, abdominal pain and tenderness, and flexed thighs are certainly far more suggestive of intestinal perforation than of any thoracic disease. Of five cases observed by Fenwick (Lancet, 1893), one was considered an attack of gallstones, another typhlitis, and a third acute peritonitis. The diagnosis is assuredly not always easy. An important step will have been taken when the possibility of diaphragmatic pleurisy is once considered and a thorough examination made with reference to it. Friction or other local signs may then afford valuable evidence, or the characteristic points of tenderness above referred to may be discovered. It is to be especially noted that in pleurisy the abdomen is not distended; the pain is often superficial, and is more closely related to cough, deep inspiration, and like efforts that in peritonitis; and dyspnoea is a symptom of far greater prominence than in any disease of the abdominal organs.

The TERMINATION of disphragmatic pleurisy is usually in recovery. Fatal cases are either purulent or complications of such serious affections as cancer, tuberculosis, or peritonitis.

The PROGNOSIS must be only guardedly favourable when these cannot be excluded.

(2) HAEMORRHAGIC PLEURISY.

SYMPTOMS.

Most authorities hold that all serofibrinous exudations contain a certain number of red

corpuscles, though usually less than six thousand per cubic centimetre were found by Dieulafoy to be requisite for the production of the faintest tinge of colour. Grawitz, however, seems to have found red corpuscles in only ten of forty-eight cases carefully examined; and since eight of these ten cases were tubercular, the question arises whether a minimum quantity of blood in an effusion has not a certain diagnostic value. But we are here dealing with exudations whichare frankly haemorrhagic, which vary in colour from a rose tint to deep-red or brown, and contain sometimes as high as ten per cent. of pure blood. Such exudations are not infrequent. At the Munich Clinic, for instance, this form was encountered fourteen times in two hundred and twenty-seven cases of pleurisy. As a rule, its occurrence may be referred to either tuberculosis, pleural or pulmonary cancer, or pleural haematoma.

In haemorrhagic pleurisy due to TUBERCULOSIS, probably in most cases of the pleura itself, the bleeding is the outcome of the great vascularity of the tubercular serous membranes, and of the marked tendency to degenerate changes in the walls of the newly-formed vessels. A haemorrhagic exudation may accompany all the various forms of tubercular pleurisy. Since the amount of blood is nearly always small, the colour of the exudate rarely presents the deeper tones of red observed in other forms. The haemorrhage, as such, has no influence upon the prognosis of the disease. Occurring in chronic forms of pulmonary or pleural tuberculosis, a haemorrhagic exudate generally loses a portion of its colour with each succeeding aspiration, and after six or eight punctures the effusion itself often disappears. It need scarcely be added that the vast majority of tubercular pleurisies are, histologically at least, non-haemorrhagic in character.

At any time a CANCER may give rise to haemorrhagic effusion. Usually latent and unnoticed, it may exceptionally be acute and violent in onset. Dutil (Gaz Méd. de Paris, 1887), for example, saw a case which began in an apparently healthy individual with severe pain and dyspnoea; there was no return of the effusion after a single aspiration, but the patient died not long afterwards of cancer of the lung. The admixture of blood is usually considerable; the colour is therefore apt to be dark-red or brown and the amount of fibrin large. As a rule, the fluid persistently reforms after its removal, and unlike a tubercular effusion, preserves its haemorrhagic nature until the patient dies.

Regarding PLEURAL HAEMATOMA, whenever a serous membrane is the subject of recurrent inflammation it may involve not only the membrane proper, but also any organised false membrane which lies upon it. The delicate vessels of the latter are easily ruptured, and from them a considerable quantity of blood may escape, either into the serous cavity or into the loose meshes of the membrane itself. Occurring in the pleura, this process may give rise to haemorrhage precisely as in pachymeningitis there may occur a haematoma of the dura mater. Although it seems probably that most of these cases are tubercular (Mesnil:- Thèse de Paris, 1894), it is certain that the condition may occur in apparently healthy individuals and end in complete recovery. The amount of

blood is often considerable, but two or three aspirations are sometimes enough to cure the patient of his disease.

It is very rare to find a haemorrhagic effusion from any other causes than those just named. It may exceptionally be associated with CARDIAC or RENAL DISEASE or with CIRRHOSIS OF THE LIVER. In individuals affected also with any form of the HAEMORRHAGIC DIATHESIS, such as scorbutus, haemophilia, purpura, pernicious anaemia, icterus, or leucaemia, a pleuritic effusion is apt to be of a haemorrhagic character.

It is seldom possible to effect a DIAGNOSIS of this form of pleurisy except by exploratory puncture, whereby it is to be remembered that any effusion may be slightly tinged with blood if the lung happens to have been wounded by the needle. In very exceptional cases the haemorrhage may be so considerable as to cause marked pallor and weakness. The proportion of blood in an effusion may be estimated by counting the red cells, or, if these are so pale as to make this method difficult, recourse may be had to Gowers' haemoglobinometer.

The TREATMENT of a haemorrhagic effusion does not differ materially from that of the ordinary form of sero-fibrinous pleurisy.

(3) CHYLOUS PLEURISY.

An extremely rare experience is to find a pleural effusion resembling chyle in appearance. Boulengier (Presse Méd. Belge, 1890) has given careful study to reported cases, and concludes that two forms must be sharply differentiated: In the first place, the pleura may unquestionably contain a genuine chyle, consisting solely of a pure emulsion of fat, and the result of injury to the thoracic duct, or, possibly, as our author thinks, to the operation of the filiaria sanguinis. Busey (Canad.Pract.,1891) has collected only ten cases of genuine chylothorax from the literature: in five of these the chyle came directly from the thoracic duct, three being traumatic. Turney has since discovered a case due to obstruction and rupture of the thoracic duct from cancerous thrombosis of the subclavian and jugular veins (Lancet, 1895). Busey considers the diagnosis impossible without puncture, and the prognosis unfavourable. In the second form, or pseudo-chylothorax, the simply "chylous" effusion is a result of the fatty metamorphosis of the cellular elements of an ordinary sero-fibrinous or, more commonly, purulent effusion. This change takes place only in cases of long standing, and a very large proportion of such empyemas are tubercular. The microscope shows numerous fat globules, degenerated leucocytes and epithelial cells, and cholesterine crystals, which are suspended in an albuminous liquid. Boulengier thinks that a sufficient number of cellular elements will always have survived to make a DIFFERENTIATION from the true form possible. These chyliform effusions have the same PROGNOSIS and TREATMENT as any chronic purulent effusion.

(4) PULSATING PLEURISY.

Despite the fact that in any large effusion upon the left a pulsation synchronous with that of the heart may exceptionally be felt or seen in several intercostal spaces of the affected side, most cases of

pulsating pleurisy are purulent, and the pulsation is limited to a well-defined tumour produced by an external pointing of the pus. The condition is very uncommon. Since attention was called to it in 1844 by McDonnel, less than a hundred cases have been reported. The pulsating tumour is almost invariably on the left front and between the second and sixth ribs: of forty-two cases reviewed by Osler it was behind in only three. Usually there is but one tumour, exceptionally two or even more. The pulsation is often intensified when the patient lies upon the opposite side. Comby finds that the great majority of cases are complicated with pneumothorax, and that in certain positions of the patient the tumour may contain nothing but air. There is no very satisfactory explanation of this pehenomenon of pulsation, but the fact that it generally ceases with the aspiration of a small quantity of fluid makes it probable, as was supposed by Traube and Bouvert, that the necessary conditions are a considerable degree of fluid tension with a locally diminished resistance of the thoracic wall. The PROGNOSIS of these cases was formerly thought to be invariably fatal, and it is certain that very many of them are tubercular. The mere presence of pulsation has no influence upon the TREATMENT of an empyema.

(5) ENCAPSULATED PLEURISY.

This variety of pleurisy must include not only effusions limited by costo-pulmonary adhesions, but also those commonly described as interlobular and mediastinal - effusions, namely, which are shut in either between two lobes of the lung or between the lung and mediastinum: the two latter forms are nearly always of a purulent character. Encapsulated pleurisies are noteworthy only as regards their physical signs and diagnosis.

Under the PHYSICAL SIGNS we may note that a dulness or flatness of greater or less extent is usually produced; but this area has no typical outline. Over it voice, respiration, and ffemitus are, it is true, usually diminished, sometimes absent; but the small size of the effusion perhaps, or contiguous areas of compressed or consolidated lung, are apt to produce confusing modifications of these signs. In interlobular effusion the dull area is usually found in the axilla or crossing it in the direction of the fissure. A mediastinal pleurisy may produce an area of flatness which includes the whole width of the sternum and extends quite a distance beyond towards the other side. When on the left it may displace the heart towards the right, and by pressure on the great vessels cause marked cyanosis, dilatation of the superficial vessels of the chest, puffiness of the face, cold extremities, and oedema of the upper part of the body (Velimirovitch:- Studies on Mediastinal Pleurisy, etc., Paris, 1892).

The DIAGNOSIS of an encapsulated pleurisy is often impossible without exploratory puncture. One is aided by any local effacement of the intercostals, and especially by an absolute flatness with sense of great resistance on percussion. A mediastinal effusion differs from a pericardial in its atypical curve - from mediastinal abscess sometimes in its greater extent and production of greater displacement of the heart. In all these forms must be taken into consideration a host of

diagnostic factors which are beyond the scope of this essay.

The TREATMENT of an encapsulated effusion must be carried out on thesame principles obtaining in the ordinary forms of pleurisy.

(6) MULTILOCULAR PLEURISY.

Multilocular encysted collections of fluid in the pleural cavity are due to partitions made by false membranes which divide the pleura into subcavities. These occur generally in subjects who have had previously had dry or adhesive pleurisies. Multilocular areolar pleurisies are more serious than the ordinary forms of pleural inflammation. We meet with them in aspirating when, after draining off the fluid from the base of the pleural cavity, we find the lung expanding, but above that point there is absence of respiratory murmur and of other physical signs indicating the presence of fluid. Reybard (Bull. Acad. de Méd., 1879) divides multilocular pleurisy into three varieties, with varying symptoms and physical signs, according to whether it exists at the upper, middle, or lower portion, right or left side. Owing to the thickening and distribution of the neo-membranes, it is frequently difficult to localise the points of collections of fluid. The exact point and extension of the effusion is most accurately determined by aspiration.

(7) DOUBLE PLEURISY.

Both sides of the chest may be affected by pleuritis. Double pleurisies are secondary, not primary, and result from rheumatism, or still more frequently, according to Louis, from tuberculosis. In one hundred and fifty cases of pleurisy cited by him, there were no bilateral cases which were not produced by rheumatism, gangrene, or tuberculosis. A double pleurisy in a previously healthy person creates a strong suspicion of tubercular origin. There is generally an interval of some days before the attack of one side is followed by that of the other. When the effusion takes place the dyspnoea is very great. Death is imminent unless the fluid is withdrawn by aspiration. Maintenon (Thèse de Paris, 1873) states that the inflammation may be so intense and the fever so high as to destroy life before the effusion is thrown out. The PHYSICAL SIGNS are the same as in unilateral cases. The effusion never is so great on one side as on the other. The progress of the disease is rapid. The PROGNOSIS is very unfavourable, as the patient nearly always dies. The TREATMENT is conducted on the same general principles as that of the ordinary forms.

(8) RHEUMATIC PLEURISY.

This variety of pleural inflammation makes its appearance in the course of acute articular rheumatism with the characteristic mobility of the points of inflammatory action. Laseque (Rheumatic Pleurisy, Arch. Gén. de Méd., 1873) devoted great attention to the subject, and gives the symptom with accurate details - the acute pain in the side of the chest without cough or expectoration. He describes the pain as differing from that of ordinary pleurisy, in that the extent of

pain is greater and not so limited, due to the fact that the rheumatism invades the aponeurotic tissue which forms the covering to the intercostal muscles. It persists longer and is wider spread. The dyspnoea is caused by the inability to move the respiratory muscles, and by the disease invading the aponeurotic centre of the diaphragm. The rapidity of the inflammation causes the sudden pain and the accompanying effusion in even a few hours. Several cases have been reported which did not follow the rule mentioned by Senx (On Rheumatic Pleurisy, Paris, 1878), that the disease, upon leaving the pleura of one side, appears in the same manner on the other. It sometimes goes to the pericardium and endocardium from the pleura. Chomel (Article - Pleurisy in Dict., in 30 vols., 1842) insisted upon the frequent examination of the heart to ascertain whether this had occurred or not. Rheumatic pleurisy does not always appear and disappear suddenly. It sometimes is gradual in progress and slow in recovery. It usually occurs when we have manifestations elsewhere, but the pleura may be the point first attacked, as is more frequently the case in pericarditis.

Several points have to be taken into consideration in effecting a DIAGNOSIS; they are hereditary or personal tendency to the disease, the character of the local pain, the mobility of the disease, violence of the pain and its rapid disappearance, and the existence of profuse sweats. The formation of pus is seldom seen.

The PROGNOSIS is unfavourable, not from the intensity of the disease, but from its being a visceral rheumatic affection. It is, moreover, frequently double, and may recur often in the sam individual.

The TREATMENT is that indicated for the parent disease, namely, the salicylates, etc. Thoracentesis is seldom indicated, because mechanically the effusion does not seriously impede respiration; if the pericardium is involved, it may be necessary to let out the liquid.

(9) PLEURISY IN THE AGED.

There are certain peculiarities of pleurisy at the extremes of life which call for special consideration. In the aged it is oftenest found with pneumonia, chronic cardiac and renal disease, and cancer. There is rarely much pain or fever, dyspnoea is moderate, and the course of the disease is slow. The outcome is always dubious.

(10) PLEURISY IN CHILDREN.

Pleurisy is very commonly encountered in children. It may be either dry, sero-fibrinous, or purulent; the latter is perhaps the most frequent form. Even infants are not exempt, though more so than older children; and, according to Rotch, the younger the child the more likely the effusion is to be of a purulent nature. SERO-FIBRINOUS pleurisy commences with violence, and its course may be even more acute than in adults. At the outset convulsions are not infrequent. Baginsky emphasises especially the constancy of a short, dry, harassing cough. Infants cannot, of course, call attention to pain; but there is often great intercostal tenderness on percussion or palpation over the affected

region, or even on merely pressing the skin. Somewhat older children are very apt to complain of the "stomach." Fever is usually high, often over 104.F., and greatly adds to the dyspnoea, which is so often produced in children by high temperature alone. Delirium is also of common occurrence. Some cases, beginning like pneumonia with repeated convulsions, may strongly suggest meningitis. In others gastric symptoms predominate - such as anorexia, nausea and vomiting, and epigastric pain. The advice given by Henoch, to examine the chest of every child with fever, is sound. The pulse is not so much affected by an increasingly large effusion as in adults. Baginsky says that the right heart in children is relatively large and strong, and is therefore better able to overcome and adapt itself to any obstruction in the lesser circulation. In older children the course of sero-fibrinous pleurisy is, as a rule, not so acute, and corresponds more nearly to the adult type. The relative frequency of latent pleurisy in childhood merits particular attention. The importance of this form in infants and younger children is all the greater because of their inability to speak of the fleeting pains or other symptoms which might call attention to the chest. Such a pleurisy may be absolutely latent. Only an increasing pallor and weakness, with perhaps some loss of flesh, finally causes the parents to seek advice. The recognition of the affection will then depend solely upon the physical examination of the chest. The PHYSICAL SIGNS of pleurisy in childhood differ but little from those in adults. Friction is said to be much softer. Bulging of the intercostals is much more frequent and pronounced. Bronchial respiration over the fluid is of common occurrence, even in small effusions. Henoch regards it as the rule. Fremitus is commonly said to be of little value because it is difficult to elicit; in my experience it is very seldom that a child cannot be made to use the voice in one way or another. Percussion curves are the same as in later years; and, owing to the great ease with which the flat area can be defined in childhood, their diagnostic value is very great. Regarding the PROGNOSIS of the condition, it may be noted that sero-fibrinous pleurisy in children is a relatively benign disease. Metabolism is more active in early life, and resorption of an effusion is usually rapid and complete. Chronic cases are occasionally met with, and may have the same outcome as in adults. Complications are few. Of these, pericarditis is relatively common, and must always be regarded as serious. Sudden death very infrequently occurs.

Cases of EMPYEMA are common in childhood; and the great frequency of the pneumococcal form, constituting probably seventy-five per cent. of all cases, may here the emphasised. This explains also the well-known benignity of empyema in children, the pneumococcus being a microbe of slight virulence and short life. Other causes are the acute infectious fevers, particularly scarlet fever; bronchopneumonia of streptococcal origin, especially when associated with influenza; and also caries of the ribs, which, according to Henoch, is a much more frequent cause than in adults. Putridity is rare. Resulting deformity of the chest is comparatively infrequent in childhood; and return to normal conditions is the rule in these cases.

The TREATMENT of simple effusion is the same as in adults, and empyema is managed on general lines.

COMPLICATIONS.

The most important complications of pleurisy are certain exceptional conditions or accidents which may give rise to sudden death; also certain peculiar attacks of a very serious nature which occasionally follow aspiration or may attend the after-treatment of purulent effusions.

A large pleural effusion by no means infrequently terminates very suddenly and unexpectedly in DEATH. Thus, Dieulafoy, in 1872, was able to collect forty reported cases of this kind. These sudden deaths may occur during the first week of a rapidly growing effusion, or much later during the convalescence. The causes of this event are undoubtedly varied. Contrary to what might be expected, in about two-thirds of the reported cases the effusion was on the right, and the hypothesis formerly advanced, that death usually results from a twisting of the great vessels consequent upon cardiac displacement, has necessarily been abandoned. In a certain proportion of cases the condition is one of syncope, due either to fatty degeneration of the heart or to an undue pressure upon it (Garland; Lichtenheim), or, in left-sided effusion with great displacement, to an acute bending and consequent obstruction of the inferior vena cava (Bartels; Fraentzel). Other causes, constituting, according to Goupil and Talamon, a considerable majority, are caused by a thrombosis of the right heart or pulmonary artery. The patient is then seized with great dyspnoea and epigastric pain; the face becomes anxious and cyanotic; the heart's action tumultuous; the pulse small and irregular; and in ten or fifteen minutes, at most, a fatal termination follows. Other possibilities of sudden death are from pericarditis, from syncope during the aspiration of fluid, and also from collapse such as may follow certain forms of irritation of the pleura.

Even the most trifling manipulations involving the pleura may, it is well known, be followed by REFLEX COMPLICATIONS of the most serious kind. In very rare instances death may immediately result, as, for example, after simple exploratory puncture with a hypodermic needle; such cases, however could hardly be explained except on the hypothesis of a diseased heart. Of much greater frequency and interest are certain cerebral attacks, associated usually with operated empyemas, and following such apparently trivial procedures as the reinsertion of a drainage-tube, probing of the pleural fistula, or a simple non-medicated lavage. Jeanselme

(Rev. de Méd., 1892) has collected forty-six cases of this sort, and that such accidents are not infrequent may be inferred from the fact that Laache (Deut.med. Woch., 1894) personally observed three cases, one of which was fatal. At least two distinct forms may be encountered (Jeanselme; Cerenville) - the convulsive form, sometimes called "pleural epilepsy", and the hemiplegic. Several days may elapse between the washing or other manipulation and the attack. Talamon (La Méd. Mod., 1893) reports a case in which, two days after puncture, there were convulsions lasting six hours, followed three weeks later by a second attack with fatal termination;this person was not epileptic, nor have any of the reported cases been in epitleptic individuals. The hemiplegic form is usually, though not invariably, attended with unconsciousness. Dilatation of one pupil and bleeding or great sensitiveness of the fistula are said to be common precursors of an attack. A cerebral embolus may be concerned in the production of a certain number of cases, but most of them can only be explained as reflex - possibly the cerebral centres, as supposed by Jeanselme, being in a state of increased sensibility from autointoxication. The prognosis is always very grave, and about fifty per cent. seems to be the mortality.

PERICARDITIS, AND PERITONITIS are the most important of the other complications of pleurisy. The former may result from any variety of inflammation involving portions of the pleura contiguous to the heart. It may be attended with effusion,and is not an uncommon cause of death; out of forty-seven cases of empyema, Laache lost three from what he describes as a chronic and insidious form of pericarditis. Peritonitis is certainly an infrequent complication of pleurisy,and its occurrence is almost wholly limited to the purulent forms. It is rapidly fatal when general;it may,however, be subphrenic and local. Empyema may also be the cause of metastatic abscesses,and these appear to have a special predilection for the brain; Hadden reports three fatal cases following empyema, one of which was of the same foetid character as the primary disease. Empyema may also be complicated with an ERYSIPELAS starting from the external wound.

Pleurisy seldom or never causes acute PNEUMONIA of the affected side,though the former is extrenely common as an antecedent; occurring in the opposite lung, it is very apt to be fatal. BRONCHITIS, usually mild and unaccompanied by expectoration, is quite common. CHRONIC INTERSTITIAL PROCESSES in the lung are possible sequels of old and recurrent forms, and the relation of pleurisy to PULMONARY TUBERCULOSIS has already been referred to. Pleurisy of the opposite side is considered by most authorities to be some indication of the tubercular character of both; certainly cases of double pleurisy may make at least a temporary recovery.

SEQUELAE.

Cases which last for some time in the suppurative condition not infrequently culminate in AMYLOID DEGENERATION of the liver, spleen, kidneys, and other internal organs. This condition is most often due to old fistulae, and is in that case a constant menace to the life of the patient.

It is a very common thing to find a sero-fibrinous pleurisy followed by TUBERCULOSIS, usually of the lung. It is, however, a mooted point whether or not phthisis, for example, is to be regarded as in any true sense a sequel of pleurisy. It is quite possible that the latter may be simply an early manifestation of infection.

By no means a small proportion of all cases of pleurisy, of whatever form, have no local consequences other than the production of ADHESIONS between the opposite pleural surfaces. These adhesions vary greatly in extent, but are seldom sufficient to seriously impair the functional activity of the lung. They consist of delicate cicatricial bands and cords, which, once formed, are usually definite, and remain unaltered through life. A diminished inspiratory exapnsion of the pulmonary margin is the only evidence of their presence. Possibly, when pleural synechia is universal, the bronchi are less able to empty themselves than under normal conditions; and there may be therefore a greater tendency to inveterate bronchial catarrhs and disturbances of the pulmonary circulation. When the great frequency of pleural adhesions is considered,- eighty per cent.of all individuals, one writer affirms,- it seems very doubtful whether these alone are responsible often for any serious impairment of the general health of the affected person.

Much more, however, is left behind than simple adhesions in a few cases of both dry and sero-fibrinous pleurisy. Either as a result of recurrent inflammation or because the pleurisy is in its nature proliferative, the pleura undergoes a gradual process of THICKENING. In sero-fibrinous pleurisy and empyema we often look for this result; the original inflammatory process never subsides, or there is a constant recurrence, and the case from the outset is apparently chronic, and probably tuberculous in character.

The case is different in the dry form. Clark called special attention to certain PROLIFERATIVE FORMS of primary dry pleurisy which are fraught with the most serious consequences as regards the subsequent health of the patient. An individual has an apparently insignificant attack of dry pleurisy. He rapidly recovers, and for a long time, years it may be, no effects of pleurisy are visible. His health remains excellent; he suffers at most from some cough and tendency to bronchitis, or there may be occasional fleeting pains in the side. In time, however, his breathing begins to be slightly affected and he has some dyspnoea on exertion. His cough now develops a paroxysmal character, and the accompanying expectoration is hard to raise. Later this bronchial insufficiency is attended by more or less septic absorption, and the general health commences to

fail. He becomes especially liable to gastric and intestinal troubles of a catarrhal nature. Finally, albuminuria appears, the condition of the kidneys from now onwards becomes progressively aggravated, and the patient ultimately dies. The condition has been known to take ten or twenty years for its evolution and final fatality. The author quoted above made a careful investigation into these cases; and found that the primary condition was an excessive thickening of the adherent pleurae, usually unilateral, and without any appearance suggestive of tubercle. In some instances this thickening amounted in places to one and a half inches. The particular feature of the process was, however, the condition of the lung. Bands of connective tissue extended from the pleura for a varying depth into the pulmonary parenchyma, sometimes along the the interlobular septa, sometimes along the bronchi, again following the course of the vessels. The fibroid process was most marked at the periphery, thus indicating its pleural origin. In extreme cases the whole lung was a mass of fibroid tissue. Often there was a secondary dilatation of the bronchi, a bronchiestasis; or, again, there were numerous cavities, which our author considered necrotic and a consequence of terminal vessels being occluded by the fibroid process. In my opinion, most of these cases of primary pleuritis vegetans are tuberculous. The thickened pleura is then found on section to consist of diffuse tuberculous tissue, partly fibroid and partly caseous. In the earlier stages, grayish or grayish-yellow tuberculous nodules may still be seen. It is the same condition which in other cases is attended by a sero-fibrinous or purulent effusion, and the lung may or may not be invaded by the fibroid process. The interesting question which Sir Andrew Clark raised is as to whether such chronic thickening and pulmonary involvement may occasionally develop quite independently of tuberculosis. His observations would seem to answer this in the affirmative, but there are not a few good observers who maintain the opposite. The physical signs of chronic proliferative pleurisy are much the same whether it results from simple dry pleurisy, as Clark maintained, or from a serous or purulent form. Cicatricial contraction of the newly-formed connective tissue in pleurae and lung results in great deformity of the chest and more or less typical displacement of organs. The affected side is seen on inspection to be much smaller than the opposite; it appears sunken and depressed; the shoulder droops, the lower angle of the scapula tilts slightly outwards, and there is a lateral curvature of the spine - usually with its convexity towards the sound side. The lower margin of the ribs is nearer the crest of the ilium, and the ribs are closer together, so that there is a narrowing of the intercostal spaces. The signs forthcoming on percussion and auscultation are very similar to those of a moderate effusion. The lower half of the thorax, at least, is quite flat, and the upper border of the flat area may resemble very closely that of a moderate effusion. Respiration below is much diminished or absent, and the voice sounds are distant and perhaps slightly bronchial. Pleural rustlings, creakings, and cracklings are often abundant over the whole side; they bear a close resemblance to pulmonary râles, but are unaffected by cough and more superficially

located. Some writers affirm that vocal fremitus is unaffected by pleural thickening; others that it is much diminished thereby. In my own experience it has varied in different cases, and I cannot attach to it any great diagnostic value. The heart may be variously fixed by adhesions; usually it is drawn towards the affected side. The diaphragm is raised, as may sometimes be recognised by the widening of traube's space. Over the upper half of the chest the signs vary so greatly, according to the condition of the upper lobe of the lung, that all sorts of conditions may be presented. It is not infrequently to distinguish this condition from effusion. Usually, of course, the past history, the sunken appearance of the chest, and the displacement of organs towards rather than from the affected side will establish the diagnosis. When, however, there are at the same time some signs of fresh pleurisy, such as pain and daily hectic, it may be not infrequently impossible, in the absence of exploratory puncture, to say that fluid is actually present. The patients ultimately die from the occurrence of chronic pleurisy and fibroid lung. Pulmonary tuberculosis, if not already developed, must be regarded as constantly threatening. If this is escaped and life is sufficiently prolonged, the patient will ultimately succomb to chronic nephritis or slow sepsis or dilatation of the right ventricle of the heart.

DIAGNOSIS.

General Diagnosis.

The presence of friction will almost entirely determine the diagnosis of acute pleurisy. In its absence mild afebrile cases are hardly to be distinguished from intercostal neuralgia or pleurodynia, while the more severe are liable to be confounded with pneumonia. In this connection it is to be remembered that in pleurisy an initial rigor is rare, dyspnoea is superficial, and there is no rusty sputum; moreover, the early physical signs of pneumonia are missed. We know of no way in which the dry form of pleurisy can be distinguished from the sero-fibrinous before the development of effusion; in general, the latter is perhaps attended by more pronounced constitutional symptoms. It is extremely easy to diagnose a typical pleuritic effusion. Among the physical signs which make this certainty possible one must unhesitatingly accord the foremost rank to those afforded by percussion. The shape of the flat area is the only constant and invariable sign of small and moderate effusions, while the existence of a large effusion is at once demonstrated by the evidences of displacement. The absence of vocal fremitus is quite constant and characteristic, and when combined with absent or diminished respiration and distant voice it makes an effusion

exceedingly probable. But all these signs may be wanting. We may hear over an effusion both bronchial respiration and bronchophony, fremitus may be distinct, and there may even be râles. This might, indeed, be anticipated when we consider the great number and variability of the factors involved in the transmission of sound from the larynx. An absolute flat area of definite shape and certain displacement phenomena are the only constant signs. To sum up,- the diagnosis of uncomplicated non-encapsulated pleuritic effusion, whether sero-fibrinous or purulent, should rest primarily upon the following signs: In small effusion an area of flatness at the posterior base bounded above by the so-called convex curve; in moderate effusion an area of flatness which is highest in the axilla, and whose upper boundary behind is the letter-of-S curve already described; in very large effusions a curve with upward concavity which crosses the shoulder; and, still more important, displacement of the diaphragm, the mediastinum, or the heart.

For the correct diagnosis of these cases exploratory puncture is not infrequently absolutely necessary. I consider it an absolutely harmless procedure when carefully done, and a legitimate method of diagnosis in all conditions and ages. The best instrument is an ordinary hypodermic syringe; but the needle should be of double length, since the usual short one will seldom reach the fluid. The needle should be boiled before puncture, and the syringe, filled with a five per cent. solution of carbolic acid, may be immersed for half an hour in a like solution. The hands and the patient's side should be aseptic. The pain produced is very slight, and may still be made less by the use of cocaine. Puncture may be made at any point within the flat area, preferably not too near the boundary, and at the base of of effusion in order to reach the thickest part of the fluid. It must be remembered that puncture above may withdraw only cloudy serum, even though the exudation be frankly purulent. In small effusion we puncture low down and a little within the line of the angle of the scapula; in moderate and large, in the sixth or seventh space in the axilla. Occasionally, when the needle is obstructed and no fluid obtained, sufficient pus may have adhered to the end of the needle to be plainly detected by the microscope. That results of great importance are to be obtained by the various methods of bacteriological examination is a cardinal point. The technique of the methods in question is fully described in appropriate works.

By means of the signs already enumerated the diagnosis from PNEUMONIA is usually easy. In consolidation of the lower lobe, the upper border of dulness is highest at the spine, from which, following the fissure, it descends by a gentle curve to a point on the sixth rib just outside the mammary line. In effusion these conditions behind are reversed: the line of flatness is lowest at the spine, highest in the axilla. The value of the signs of displacement in these cases liable to be mistaken for pneumonia is slight, since, as a rule, but little perceptible displacement exists. It is only when on the left that a moderate effusion causes an easily perceptible displacement of the heart towards the right, which is of considerable assistance in the

diagnosis between these two diseases. Other signs should not be neglected. Increased vocal fremitus, loud bronchial respiration and bronchophony, and numerous râles are certainly the rule in consolidation, the exception in effusion. While no one of these signs approaches in value the evidence afforded by percussion, their confirmatory value is very great.

Not infrequently considerable difficulty in diagnosis is presented by old cases of pleurisy with GREAT THICKENING of the pleura and possibly also FIBROID CHANGES in the contiguous lung. The lower part of the chest is found to be full or flat, with distant voice and respiration. In distinguishing this condition from effusion the following points are of service: In the former there is often marked retraction of the chest wall; there is a history of chronic disease; the upper border of flatness is not always sharply defined, and its curve is often atypical; vocal fremitus is often but slightly diminished or normal; and the heart is frequently drawn towards the affected side, while signs of emphysema are noticed in the opposite lung.

A pleuritic effusion on the right side may be simulated by an UPWARD DISPLACEMENT OF THE LIVER or a SUBPHRENIC ABSCESS. Here, again, the line of flatness is the determining factor in diagnosis. In both of these conditions we find, as a rule, a symmetrical elevation of the pulmonary hepatic boundary - a sharply defined horizontal line of flatness at the level of the fifth, fourth, or possibly even the third rib. In effusion such a line is never encountered, except possibly in rare instances of the diaphragmatic form. An hepatic abscess or cancer may sometimes cause an irregularity of the upper boundary of the liver, but it is very doubtful if this could ever simulate the curve which an effusion presents.

Not infrequently there are no characteristic signs presented by atypical or encapsulated effusions, such as result from adhesions which limit the exudate or prevent the ordinary retraction of the lung towards the spine. They are liable to be mistaken for PNEUMONIC CONSOLIDATIONS, ABSCESSES OF THE LUNG, BRONCHIAL GLANDS, or MEDIASTINUM, PERIPLEURITIC ABSCESS, HYDATIDS, and MALIGNANT NEW GROWTHS. Numerous points of diagnosis are here involved. After carefully weighing the history, the age and general condition, the degree of local bulging perhaps, or of displacement, in most cases the only certain evidence of fluid will be afforded by an exploratory puncture.

The latter procedure is usually necessary for the recognition of the **NATURE OF AN EXUDATE**. It is precisely in the differential diagnosis between serous, haemorrhagic, and purulent effusions that exploratory puncture finds its widest field of usefulness. A localised oedema is a fairly reliable sign of PUS, but is found only in a small minority of cases, and may even accompany the non-purulent forms. The so-called sign of Bacelli,- the transmission, namely, of the whispered voice through a serous exudation only,- though not devoid of value, is now generally admitted to be unreliable; exceptions are much too frequent. A daily hectic is strongly suggestive of pus - may, however, be present in sero-fibrinous pleurisy, while in empyema the rise of temperature may

exceptionally be very slight. Still, in cases where with daily hectic there are occasional rigors, or great weakness and emaciation with a pale, puffy face and slight oedema of the limbs, the effusion is in all probability of a purulent character. Finally, it may be noted that there are no absolutely characteristic signs of haemorrhagic effusion. It can only be occasionally suspected in cases of cancer, pulmonary tuberculosis, or haemorrhagic diathesis, especially when a noticeable pallor has rapidly developed. The diagnosis of air above the fluid must depend upon succussion and the evidence of a changing horizontal level of fluid. Hydrothorax has the same curve as effusion, but is rarely unilateral, and is generally associated with general anasarca dependent upon chronic diseases of the kidneys, heart, or lungs.

PROGNOSIS.

In all forms of pleuritic inflammation the possible association with OTHER AFFECTIONS must be taken into consideration. It is evident that the prognosis of a pleurisy which accompanies puerperal or malignant scarlet fever or hepatic abscess depends but little upon the pleurisy itself. So also with renal and cardiac affections and advanced pulmonary tuberculosis: the complicating pleurisy is often important only as a terminal ailment. The probable outcome of such cases of primary pleurisy as are apparently uncomplicated by any serious general condition will therefore only be considered here.

The prognosis in cases of SIMPLE DRY PLEURISY is never grave, although the possibility of the eventual development of fibroid lung or tuberculosis must be borne in mind. Smith (Med. News, 1890) had sixteen cases of uncomplicated dry pleurisy under constant observation during fourteen years, and he tells us that some form of tuberculosis occurred in five of them.

One is justified in giving a favourable IMMEDIATE PROGNOSIS in cases of PRIMARY SERO-FIBRINOUS PLEURISY. Engster (Deut. Arch. f. klin.Med., Vol.xlv.) reports three deaths in one hundred and seven cases; Catrin (Soc. Méd des Hôp., 1892), only one death in seventy-five. The mortality is greatest at the extremes of life, and there is always some immediate danger when the effusion is large and attended by marked displacement, or particularly when the case is complicated by pericarditis. A small or moderate effusion may, in general, be expected to recover fully in from four to eight weeks. Rheumatic cases are said to be especially benign and only of a few days' duration. But the REMOTE PROGNOSIS is always uncertain. I have already shown with what frequency pulmonary tuberculosis follows even the mildest cases of primary pleurisy. More or less unfavourable symptoms are high and persistent fever, very large amount of fluid, no signs of absorption

after the third or fourth week, and rapid recurrence of the exudate after aspiration. Under these conditions especially, and also in any of the chronic latent forms, the tubercular nature of the affection and the subsequent development of other more serious forms of tuberculosis must be regarded as highly improbable. Still, even here there may be ultimate complete recovery, or the effusion may be carried about for an indefinite period with maintenance of fair general health: such cases of chronic effusion may live as long as twelve or fifteen years. There is a risk of some permanent deformity of the chest after large effusions and all chronic forms, except in childhood.

An EMPYEMA, when left to itself, is generally fatal. Very exceptional cases may recover by spontaneous evacuation, or, still more rarely, a purulent exudate may undergo fatty metamorphosis and be absorbed. As a rule, if the patient escapes the various complications from pressure, inflammation from contiguity, and metastasis, he succombs eventually to sepsis and progressive exhaustion. On the other hand, when empyema is submitted to timely and adequate operation the progmosis is excellent, provided, of course, there is no other incurable affection. Thus, Morrison (Lancet, 1894) operated thirty-four private cases in children with but two deaths; Koenig (Berl. klin. Woch., 1891) reports seventy-six successive cases of all sorts operated by himself in the course of ten years: of these, ten died - that is, of pyaemia, one moribund on admission, and the other five of causes quite independent of the pleurisy; of the remaining sixty-six, fifty-nine were completely cured, three were lost sight of, and four had fistulae. Runeberg (Zeit. f. klin. Med., xxi.) operated sixty-one cases during five years: two were tubercular and died with fistulae; ten were secondary to pulmonary gangrene, and of these four died; one died of erysipelas; of the remaining forty-eight uncomplicated cases, forty-six were completely cured after an average duration of forty-eight days. Averaging the above three series would give a mortality of ten per cent. in one hundred and seventy-one unselected cases, and a complete cure in ninety-three per cent. of uncomplicated cases. This is undoubtedly optimistic, but it shows what may be accomplished by the modern methods of treatment. The individual case must be judged on its own merits. Up to the third year of life the prognosis certainly is grave in all forms: Wightmann (Lancet, 1894) in a series of one hundred and twenty-four cases of empyema in children lost fifty-per cent. of those under three years of age. Unquestionably the most benignant form of empyema is that produced by the pneumococcus: nearly all cases in fairly healthy persons recover when properly treated. Rupture into the lung does not materially affect the prognosis. Streptococcus empyema is, on the whole, a much less favourable variety, but here also, in uncomplicated cases, recovery may be confidently expected. Putrid forms are nearly always grave, and death may occur within the first two weeks; not infrequently, however, the pus gradually loses its foetid character after operation and the case proceeds to complete recovery. Tubercular empyema usually ends sooner or later in death, though this may be only after months or even

years of fairly good health.

Finally, we may consider briefly the prognosis in certain EXCEPTIONAL VARIETIES and CONDITIONS, firstly noting that SPONTANEOUS EVACUATION is likely to prove fatal if the pus has made its way below the diaphragm: above, through the chest wall, it somewhat impairs the prognosis, though not very materially. Runeberg's uncomplicated cases of spontaneous evacuation, among them eleven into the lung, all recovered after operation, and he is of the opinion that in this event the prognosis is but little affected. DOUBLE EMPYEMA is exceedingly grave, but by no means desperate; numerous favourable cases have been reported, particularly in children, and it is at least a matter of great doubt whether, as formerly supposed, all double pleurisies are necessarily tubercular. In ENCAPSULATED FORMS the prognosis must depend largely upon the nature of the exudate and its accessibility; even when unoperated a favourable termination by vomica,- as, for example, in the interlobar form, is not uncommonly observed. The result of HAEMORRHAGIC PLEURISY will depend more on the primary lesion than upon the mere presence of blood: the great majority of non-traumatic cases, being secondary to tuberculosis or cancer, are of very doubtful prognosis, though in the former recovery is possible. About fifty per cent, of the cases of pleural epilepsy and other cerebral complications die; and in them the prognosis is about as bad as it could possibly be.

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T R E A T M E N T.

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TREATMENT OF THE INITIAL STAGE.

There can be no early distinction in treatment, since it is usually impossible to determine at the onset of an acute pleurisy, or for several days later, whether or not effusion will develop.

The RELIEF OF PAIN, as a rule, is the first and most urgent indication in dealing with the first or dry stage of the disease. For this purpose OPIUM in some form is usually indispensable. Since a single dose is often insufficient, I prefer the hypodermic method, which permits of frequent repetition. A fiftieth of a grain of morphia may, however, be given by the mouth hourly until the pain is relieved, if preferred.

In addition to the narcotic, a certain amount of local REVULSION is usually indicated. Sometimes it is best to begin with the application of three or four DRY CUPS. Following these, a hot linseed POULTICE, to which mustard may be added, is a grateful application, though in some instances an ICEBAG gives greater relief. The poultice should be large, thick, and frequently renewed: Garland suggests for this purpose a bag of old flannel, which may be often refilled without acquiring

a disagreeable odour.

In place of these applications, or combined with them, it is often advisable to immobilise the side by STRAPPING. Especially in the milder forms of dry pleurisy, such as so often accompany pulmonary tuberculosis, I have found this measure of great service. Two or three two-inch strips of adhesive plaster may be used, applied during expiration so as to overlap the median line in front and behind; or, instead of plaster, a BANDAGE may be applied, either a few turns of an ordinary elastic bandage or a cotton roller, as preferred by Otto, as much as possible of the side being left uncovered; Otto's results would seem to indicate that in the management of the acute stage of the affection a well-fitting bandage is a most valuable measure.

Rest in BED is absolutely necessary in all cases of acute pleuritic inflammation. This applies not only to the primary stage, but also to the subsequent period of development and increase of the effusion. It is only when the latter has been for some time stationary, or, in large effusion, when absorption has already begun, that the patient should be allowed to go about. This point has from time to time been emphasised by reliable authorities; and the experiments of Dybkowski, showing that during the early stages there is an increased tendency to exudation when respiratory movements are active, point in the same direction.

The BOWELS should, as far as possible, be kept somewhat freer than normal.

In some of the cases with high fever COLD SPONGING and other antipyretic measures materially contribute to the comfort of the patient, and when indicated should always be employed.

The question of a SPECIFIC TREATMENT for pleurisy is one that has been much debated in the past. In those rare cases which are manifestly due to SYPHILIS, rapid improvement may be expected from the use of MERCURY and the IODIDES (Pretorius:- Ann. de la Soc. de Méd. d'Anvers, 1891). Cases arising from TUBERCULOSIS should be put upon large doses of CREOSOTE, according to Velten (Berl. klin. Wochn., 1893); I should prefer to at least restrict its use to subacute and chronic forms. Much greater interest attaches to the employment of the SALICYLATES in cases associated with RHEUMATISM, as well as in those which are apparently IDIOPATHIC. A consideration of the etiology of pleurisy makes it evident that this medication must often prove futile, but the great benefit occasionally derived makes it appear justifiable to give each case the benefit of any doubt. From a large number of favourable reports upon the use of the salicylates in pleurisy I select the following: L. Koester (Therap. Monat., 1892) treated twenty-seven cases of primary pleurisy with the salicylates, all cases of small or moderate effusion; the results of seventeen of these are described as excellent, that is, rapid fall of temperature, diminution of dyspnoea on the second day, increased diuresis even before any evidence of resorption, and rapid disappearance of the effusion. The usual dose of the salicylate of soda is a drachm to a drachm and a half per diem. I prefer to use it only during the acute stage, but its exhibition at a later period is also recommended by several writers.

TREATMENT OF SIMPLE EFFUSION.

It is generally useless, in the absence of special indications, to employ any very active measures for the removal of the effusion during the ACUTE FORMATIVE STAGE of the process; one can only attempt to hinder the formation of an excessive quantity. This applies especially to typical cases where the stage of exudation lasts from ten to fourteen days.

During this period the patient should be kept strictly in BED. His DIET should be light and nutritious, the bowels opened two or three times daily by saline APERIENTS, and fever, if present, be partially controlled by COLD SPONGING. In the majority of cases SODIUM SALICYLATE is given, ten grains, every two to four hours throughout this period, intermitting, of course, with the appearance of deafness or tinnitus. It is my custom to commence the application of IODINE or small fly BLISTERS to the flat area as soon as further poulticing is contraindicated by the cessation of pain.

The REMOVAL of the effusion is the prime object of treatment when the former has reached the "période d'etat; its removal may be attempted by either medicinal or operative measures.

MEDICINAL MEASURES.

Medicinal treatment can be expected to accomplish results in only a limited number of small, or at mostmoderate, effusions. I believe that the best authority of the present day is strongly opposed to the prolonged use of such treatment exclusively, and to its continuance after a week or ten days have shown it to be inadequate. It is to be recommended only in comparatively robust individuals during the early stages of the "période d'etat", at the time when nature is endeavouring to effect a spontaneous cure. Such treatment may consist in either catharsis or diuresis.

I consider CATHARSIS by far the more efficacious of the two, and the form to be preferred is the so-called METHOD OF HAY, that is, catharsis with a dry diet. The quantity of ingested liquids is limited to a pint or thereabouts in the twenty-four hours, and saline aperients are given, to the production of rather free watery stools. The rationale of the method is evident. The cathartic used is generally the sulphate of magnesium, half an ounce or more, morning and night, though any other suitable preparation may be employed. These cathartics should be administered in as concentrated a form as possible. This method is widely advocated as not infrequently producing rapid absorption of the effusion; but it should be reserved for fairly robust patients, and employed only with the utmost caution in those who are debilitated from any cause.

I regard DIURETICS as not nearly so reliable; and not a few writers tell us that they have found them absolutely useless. This is especially affirmed of the usual combination of infusion of DIGITALIS with acetate of POTASH or SQUILLS. My own experience with these remedies coincides with this view, and I have a preference for CAFFEINE with BENZOATE of soda, two grains of each in a capsule every two to three hours. Osler speaks favourably of DIURETIN; it must be given in doses of a drachm to a drachm and a half per diem - a dosage, by

the way, which sometimes makes it necessary to consider the question of expense. That an exclusively MILK DIET does, as is claimed, produce a diuresis which takes anything from the pleura is extremely improbable.

I may further mention that in suitable cases, chiefly subacute, the addition of a ferruginous or other TONIC to the diuretic employed appears to intensify its effect. Fraentzel, for instance, speaks of the brilliant results in certain cases from the combination of cinchona with the acetate of potash. The syrup of the iodide of iron and the tincture of the perchloride of that metal are highly also to be recommended.

Local COUNTERIRRITATION, by fly or other blisters or the tincture of iodine may be continued during this stage. The paintings with iodine, made so as to include accurately the flat area, also serve to mark the original line of the exudate.

OPERATIVE MEASURES.

The operative measures for the relief of a simple pleuritic effusion comprise the performance of the well-known method of a s p i r a t i o n (tapping or thoracentesis), the desirability of which, when indicated, it seems almost unnecessary at the present day to defend. No one now believes that when ordinary care is observed it ever converts a serous into a purulent exudation, or that, except in the most exceptional instances, it need be responsible for sudden death. Thanks to the teaching of Dieulafoy, Bowditch, and others, all practitioners have now learned to perform this easy operation with confidence and safety. Therefore, the exact conditions under which it is to be employed need only here be considered.

Indications.

These are of a threefold character. Authorities are agreed as to the first two, but some inclined to question the third.

1. Indicatio Vitalis.- In such cases as the life of the patient is directly threatened or endangered, immediate partial aspiration is demanded in all effusions of whatever size or character. The alarming symptoms may be those of pure asphyxia from compression, or of cardiac weakness as shown by a rapid and feeble pulse. Dyspnoea alone is not necessarily urgent, but if it is persistent and independent of pain, or especially if it tends towards temporary attacks even of orthopnoea, danger is surely at hand. Under any of these conditions delay is extremely dangerous, although the withdrawal of more than a small amount of the liquid at once is both unnecessary and unsafe.

2. Large Effusion.- Should the effusion have risen to the third interspace in front, no matter how rapidly it has formed or how little opportunity has been given for the trial of medicinal measures, by early operative interference not only is a dangerous increase forestalled, but a step is taken which experience has shown would have been ultimately necessary, since it is very uncommon to find within a reasonable time a spontaneous disappearance of effusions of this magnitude.

3. Moderate and Small Effusions.- In the case of small and even moderate effusions, when spontaneous absorption is unduly delayed, different views are still expressed regarding just how long we should wait before operating; all, however, agree that there is less risk

in haste than in delay. No inflexible rule can be laid down which is applicable to all cases. The "période d'etat of several days' duration is, so to speak, a normal incident of acute pleurisy. When, therefore, an effusion has pursued a typical course of acute rise - one to two, rarely three, weeks - followed by a stationary period, I would wait until the latter has lasted at least seven days before aspiration. In atypical cases, where the amount of fluid oscillates or tends to steadily rise, it is best to puncture in about three weeks from the date of onset. In a case with indefinite history, seen for the first time with established effusion, I would aspirate at once, or in a tolerably robust individual wait perhaps seven days at most for the trial of internal remedies. In general, the greater the debility, dyspnoea, or cardiac weakness, the earlier should aspiration be performed.

Technique.

There are numerous instruments and apparatus available for the performance of aspiration; my favourate applicance is the well-known bottle-aspirator of Potain. A large bottle is connected with two rubber tubes, each provided with a stopcock, both with an aspirating needle and an air-pump; by the latter the air in the bottle is partially exhausted, so that suction is exerted upon any fluid into which the needle may be plunged. This apparatus is simple, easily kept in order, and its action is steady. Robinson (Med. Rec.,1893) recommends the Allen pump. Bowditch preferred the simple Dieulafoy barrel, chiefly because of the accuracy with which the operator can estimate the amount of suction employed. The needle used in aspiration should be very small: it need not necessarily be more than ½ mm. in diameter, though I prefer one of about double this size - equal to that of a No. 4 French Bougie. This matter of the size of the needle is extremely important, not so much as regards the avoidance of pain as because of the necessity that the fluid should be removed very slowly and gradually. In exceptional cases of thick, grumous exudate the small needle may have to be withdrawn and a larger one substituted, though it is surprising how rarely this is necessary. A sharp hollow needle is generally preferable to a trocar, both because of its less painful introduction, and because of its smaller calibre.

Site of Puncture.- This is not a matter of very great moment. It must be high enough to avoid the costo-diaphragmatic gutter - two or three inches at least above the lower boundary of the lung, as best determined by percussion of the opposite side - and for manifest reasons a considerable distance below the upper level of the fluid. In small effusions it may be about halfway between the spine and the posterior axillary line; in a larger effusion the axillary region is generally preferred at the fifth or sixth space or at a point farther forward and a little higher, though still outside the mammary line.

Position of the Patient.- The patient may be operated upon in the sitting posture or semi-recumbent upon the edge of the bed and slightly rotated towards the affectes side; or he may, if preferred, sit sideways in a chair with arm resting upon the back thereof.

Asepsis.- The practise of aspiration always calls for the observance of the strictest aseptic precautions. The patient's skin at the site of puncture and the hands of the operator must be thoroughly sterilised with brush, perchloride, and ether, etc., as for any more extensive surgical procedure. The needle should be boiled for twenty minutes, and the proximate tube of the aspirator soaked for one hour in a five per cent. carbolic or other approved antiseptic solution. The formation of pus will never occur if these important details are duly attended to.

Anaesthesia.- I never give a general anaesthetic before aspirating; for I find the same not only unnecessary, but objectionable. Locally, an injection of cocaine, or an ether spray, or even the application of ice and salt, may profitably be used to lessen pain. The administration of an ounce of whisky is often a useful prelude to operating.

Introduction of the Needle.- After carefully locating the intercostal space with the tip of the left index finger, the needle, once entered, is thrust vigorously forward into the chest cavity. If the hollow needle is used, a preliminary incision through the skin is unnecessary. Any boring motion of the instrument is to be avoided. The advice is usually given to keep close to the upper margin of the lower rib, in order to avoid the intercostal artery; I consider this danger somewhat chimerical, and prefer rather to penetrate as nearly as possible in the middle of the space, since pain is much increased by the scraping of the bone. Often the space is so narrow that it is necessary to advance the needle with considerable caution until it has once engaged between the ribs, when the thrust may be more vigorous. We can tell that the needle has entered the effusion by the sense of diminished resistance experienced.

Amount of Fluid to be Withdrawn.- I am of the opinion that this is one of the most important, if not the most important, considerations in connection with aspiration. It must be determined by the immediate effect of the operation upon the patient. Bowditch used to say: "Tell me as soon as you feel the slightest discomfort - either pain or a sense of constriction or desire to cough"; in either event he temporarily suspended the aspiration or, in case of recurrence of the symptoms, withdrew the needle. I can suggest no better rule as to the minimum quantity to be removed. As to the maximum, while it is true that immense quantities - one hundred and twenty-six ounces from one pleural cavity - have been removed with impunity at a single sitting, it is also certain that large aspirations have been responsible for a considerable proportion of the reported cases of sudden death and pulmonary oedema. For this reason especially, and also because a small aspiration is usually sufficient to inaugurate the rapid absorption of an effusion hitherto stagnant, moderation is imperative. I consider the following a good general rule: In most cases to be content with the removal of two pints; never to withdraw more than three pints at a single sitting, even where no ill effects are apparent and it seems absolutely safe to proceed. Netter advises the removal of about two pints every alternate

day until the chest is emptied;and it is certainly far better to repeat the aspiration several times, if necessary, than to subject the patient to any risk. If the above quantity be not exceeded, there can be no objection to wholly emptying the chest at once, provided there are no subjective symptoms of distress. But complete removal is no special desideratum,and never to be sought at the expense of the least danger, or even discomfort, to the subject of the disease.

Dressing.- But for collodion or a piece of adhesive plaster, I do not consider it necessary to apply any dressing to the wound. For at least twenty-four hours after the operation the patient should be strictly confined to bed. Powell warmly favours a firm strapping of the side immediately following theoperation, believing that it will hinder a reaccumulation; in view,however, of Dybkowski's experiments as to the favourable effect of respiration upon pleural absorption, it may well be questioned whether such strapping might not have the opposite effect and seriously delay the final and complete removal of the remains of the exudate.

Prognosis.- Death from aspiration is nowadays extremely rare,though the operation carelessly performed is not without danger. Aspiration has now become so universal that the tendency of late years is perhaps to regard it too lightly. We cannot afford to disregard the bitter experience of our predecessors with large cannulas and abundant aspirations. Deaths from pulmonary oedema - both of the compressed and of the opposite lung - from pulmonary embolism, cardiac thrombosis, and syncope were not so very inffequent when it was common to rapidly withdraw large quantities of fluid. The sudden filling of the paralysed vessels of the compressed lung, and the almost violent return of the heart and great vessels to their normal position, which may result from rapidly emptying the chest, easily account for these frequently fatal sequalae of aspiration. The slow removal of only a moderate quantity seems to be that feature of the present method which ensures its almost absolute safety. Dieulafoy could find no case of death from aspiration in which not more than twelve hundred cubic centimetres were withdrawn. If, therefore, one thousand cubic centimetres are not exceeded; if this amount is removed slowly and cautiously; if any appearance of distress, such as constriction, pain, dyspnoea, violent cough, or syncope, is regarded as an imperative signal of danger - aspiration maybe performed, as shown by the statistics of Bowditch, Mason, Fraentzel, and others, in an indefinite number of cases without a fatal result. There are only very trivial other risks attendant upon thoracentesis. Instances of accidental puncture of the liver or spleen were without harmful consequences. The danger also of seriously wounding the lung is very small:cases are numerous where it had been inadvertently pricked with perfect impunity. The entrance of air into the pleura is hardly possible with careful management of the aspirators now used;it is, of course, to be carefully avoided, but even should it occur it is very doubtful whether this alone would ever result in the development of pus; it certainly does not, as a rule. Tapping the pleural cavity is a harmless procedure and a most valuable means of relief

and cure when sterile instruments and proper care are used.

MISCELLANEOUS CONSIDERATIONS.

Having considered growing or stationary effusions, we may now note the following additional facts: An effusion may be perceptibly on the decline, and yet theprocess be extremely slow and tedious. Such cases need tonics, and the addition of a good preparation of iron to the diuretic or other treatment employed is often followed by the most satisfactory results. On other cases absorption may be furthered by increased pulmonary exercise, especially in combination with a change of climate. I have already alluded to the conclusions reached experimentally by Dybkowski, that the absorption of an effusion takes place wholly through the costal pleura, and that the respiratory act is largely concerned in the process. Nothing, therefore, could so meet the indications in many cases of slowly diminishing effusion as the moderate stimulus to respiration, and the general tonic influence incident to a residence in a mountainous and elevated region. The same is also true of cases more distinctly convalescent, where all the fluid may be presumed to have been absorbed; few of these would fail to be benefited by the removal for a few weeks or months to a higher altitude. When circumstances render this impossible, substitutes must be sought for: we must endeavour to assist nature in effecting a perfect re-expansion of the lung. To this end mild gymnastics are indicated, as, for example, with light Indian clubs, pulley-weights, and especially walking or even running. Blowing the breath into bottles is a simple and effective means of carrying out pulmonary gymnastics. The risk of the development of pulmonary tuberculosis must always be borne in mind, even when the last remnant of an effusion or its effects has entirely disappeared. In many cases of poor physique, doubtful antecedents, or unfavourable surroundings, the only unquestionable course to pursue would be to advise a permanent residence in a more favourable climate. At least the patient should be kept under observation, treated for any ailments arising, and take as much open-air exercise as possible.

TREATMENT OF EMPYEMA.

Generally speaking, empyema must always be treated by an operation, which has for its object the removal of the purulent effusion. The following are the principal methods in use at the present day:

I. ASPIRATION.

Comparatively few cases of empyema can be cured by tapping the chest. There can be no doubt, in view of its abuse in this affection, that the mortality of empyema would be greatly lessened if it were always laid down as an inflexible rule to incise and drain. Nevertheless, such rule would unquestionably do violence to the truth for the benefit of the careless and undiscriminating physician. Certain cases do recover after simple aspiration, the residue of pus undergoing complete absorption with apparent restitutio ad integrum of the affected side.

A single aspiration is INDICATED under the three following conditions: First, in response to the

indicatio vitalis. When immediate danger threatens, as from compression or oedema of the lung, and when, because of great weakness of the patient or from other reasons, the radical operation cannot at once be performed. Here aspiration is merely a temporary expedient, to be shortly followed by a permanent opening. Second, in the empyema of infancy or early childhood, whenever, owing to a fair general condition, no risk is incurred in a slight delay. A large proportion of these cases, though not manifestly pneumococcal, and show, therefore, but little tendency to become septic. It is true that most of them will eventually come to further operation, but if even a small proportion can be cured by so simple a procedure as aspiration, it would seem wise in proper cases to make the trial. It is to be strongly emphasised that such trial is permissible only in the absence of all threatening symptoms, and that in case of failure but a very few days should be allowed to elapse before resorting to the radical operation. As evidences of failure we should regard a rapid re-formation of pus or persistence or immediate return of a high degree of temperature. If, on the other hand, aspiration is at once followed by a pronounced and permanent fall of temperature, with return of appetite and a constantly increasing general euphoria, any further interference may be safely deferred. The younger the child, down perhaps to the second year, the better are the prospects of success resulting. Third, in those adult empyemas which are manifestly pneumococcal it is perhaps to be considered justifiable to pursue the same course as in infancy and childhood; a very considerable number of favourable results have been from time to time reported. Netter, for example, has seen ten cases of empyema in adults cured by simple aspiration. It is claimed for this method not merely that it is milder, but especially that it insures an earlier and more complete expansion of the lung on the affected side.

It is my custom to perform a single aspiration only when the amount of pus is small, the general condition excellent, and the etiological evidence conclusive. Netter insists that there should be no mixed infection, but a pure culture of the pneumococcus. Under such conditions the procedure is possibly admissible, though even here general opinion is at the present time almost unanimous in favour of the radical procedure.

Considerable controversy has raged around the question as to the best course to adopt in those chronic and latent forms of empyema which are manifestly tubercular. The results of free incision in such cases are extremely discouraging. Not only are recoveries very rare, but there can be no doubt that life is frequently shortened by the exhausting and often subsequently putrid discharge. Moutard-Martin lost all of seven operated cases. Kroenlein had but four recoveries in fifteen; and so the list of unfavourable results might be multiplied - whereby it is also to be stated that in many reported series there was no bacteriological proof of tubercular empyema, but its existence was simply inferred from the fact that the affected individuals were phthisical. On the other hand, when not submitted to operation these tubercular cases often run an extremely slow and relatively benign course. It

therefore is not surprising that there are recognised authorities who advocate repeated aspiration as the most serviceable and conservative procedure. It will be observed that reference is here made to genuinely tubercular cases of chronic character, and not to those which are merely complications of pulmonary tuberculosis;many of the latter are non-tubercular, and not infrequently of more or less acute onset and course; such cases - usually streptococcal - should of course be at once submitted to the radical operation. In the genuinely tubercular form one must sharply individualise. If the lungs are known to be seriously diseased and there is little or no hope of recovery from the pulmonary affection, little can be said in favour of anything more than palliative aspirations. If the lungs are sound or nearly so, much depends upon the ability of the compressed lung to re-expand, and the correspondingly diminished chances of a permanent fistula. Baumler (Deut. med. Woch., 1894) advises in such cases a preliminary aspiration. If on withdrawal of one thousand cubic centimetres or more of pus there is no pain or marked tendency to cough, no cyanosis or smallness and frequency of the pulse, he would infer that the lung is still capable of expansion, and would soon venture the radical operation. If, on the contrary, by the development of the above symptoms the lung should prove itself incapable of expansion, he would repeat the aspiration at longer or shorter intervals, and be guided as to further measures by the degree of reaction to each aspiration and of improvement in general condition. In case of satisfactory progress he would finally attempt a permanent cure,either by the Bülau nethod as being mildest, or possibly even by thoracotomy. In intermediate forms, where there is evident phthisis, but no great improvement of general health, it is difficult to decide upon the best course to pursue, and it must be left to the physician to determine his action according to indications observed. In all cases not included under the foregoing conditions, and even in these, except the first, if the operator be so disposed, immediate free evacuation and drainage are indicated, whatever the amount of pus or the general condition of the patient. There is no contraindication. Even where there is an external opening the usual operation should be performed and the fistula itself opened up and scraped.

There is a difference of opinion as to the best SITE FOR INCISION. By some the eighth or ninth interspace behind, just below the angle of the scapula, is pfeferred, as affording the most perfect drainage in the usual recumbent position of the patient. But this location is open to the objection that the ribs are here closer together, the chest wall thicker, and especially that a subsequent rise of the diaphragm is apt to bring the end of the drain into the costo-diaphragmatic gutter. Most operators therefore choose the mid-axillary line from the fourth to the sixth rib,and experience in my case has shown that perfedtly satisfactory drainage can be obtained by making an opening at this point.

Most authorities are agreed as to the OPERATION ITSELF. It is extremely rare that any other method is followed than that of either simple incision with

resection or incision with resection of a small portion of a rib. The so-called Bülau method - that of siphon drainage - has found but little favour outside of Germany, although it has given some excellent results and is warmly advocated by various observers in the same country. It consists in puncture with a large trocar and canula, through which a Nélaton catheter is introduced into the chest; the cannula is then withdrawn, leaving the catheter to remain permanently in situ; to the latter is attached a long rubber tube ending in a small bottle partly filled with an antiseptic solution: this bottle may then be carried about by the patient, and is sometimes provided with a second tube through which suction may be made in case of obstruction. It is claimed that the siphon insures a constant and satisfactory drainage, and that the absolute exlcusion of air greatly favours the re-expansion of the lung. On the other hand, the method is objected to on the ground that the catheter often gets occluded; that it is apt to become loosened, so that air enters about it and destroys the siphonage; and that, after all, the drainage through so small a tube must often prove insufficient, particularly when the exudate is full of clumps. Again, on account of the constant care demanded, the method is manifestly inapplicable to children. It is, however, to be stated that good results were obtained by Curschmann in sixty-three out of seventy-five cases thus treated - by Immermann in fifty-seven cases, forty-nine complete cures.

II. SIMPLE INCISION.

It seems to me that the only advantage of simple incision or thoracotomy over resection is that it is, on the whole, a more trivial operation, and can be done, if necessary, with only local anaesthesia. It is therefore to be preferred in certain cases in adults where general anaesthesia would be dangerous; and by very common consent it is the most desirable operation for most cases in children, although here, when there is no contraindication, most operators use a general anaesthetic, preferably chloroform because it insures a quieter respiration than ether, and therefore less danger of a possible rupture of the empyema into the lung during operation. For local anaesthesia an ether spray may be used, or the subcutaneous injection of cocaine; or a piece of ice, a couple of inches square and with flat surface, may be dipped in salt and applied to the chest for twenty to thirty seconds, as recommended by Powell. Operation should always be preceded by an exploratory puncture. The incision is made, under the usual antiseptic precuations, in the middle of the selected interspace, about two inches in length and down to the intercostal muscle; the pleura may then be reached, either by gradual dissection or by the use of a grooved trocar along which the knife is thrust rapidly into the cavity. This incision through the muscles and pleura need not be over an inch in length, and in order to avoid the intercostal artery should be as close as possible to the lower rib. After most of the pus has been allowed to slowly escape, a good-sized drainage tube, guarded externally by a large safety-pin, is inserted so as to project not more than two or three inches into the cavity. The whole side, including

the arm, is then covered with a regular surgical dressing, particular care being taken to thickly pad the armpit.

III. THORACOTOMY WITH RESECTION.

The resection of one or two inches of a single rib has very decided advantages over simple incision in all cases in adults in which a general anaesthetic can be administered. These advtantages appear to consist almost wholly in the freer drainage afforded by the larger opening, facilitating especially the ready escape of the fibrinous clumps so frequently present. Beck (Med. Rec., 1893) considers it also extremely desirable to be able to insert the finger and sweep it about for the purpose of freely opening up at least the immediate neighbourhood of the drain. Laache (Deut. med. Woch., 1894), again, in the choice of resection puts especial weight upon his observation that the more perfect drainage insured by this method obviates the subsequent necessity of irrigation with its attendant dangers. Whatever may be the explanation, it must be admitted that resection has given, in general, better results than simple pleurotomy, and that at the present time it is preferred by the great majority of operators throughout the world. Simmonett (Thèse de Bâsle, 1889) in seventy-nine cases of resection collected by him there were fifty-five complete cures, while in one hundred and seven cases of incision alone only sixty recovered. The remarkable results also obtained by Runeberg were all in cases of resection. The subperiosteal removal of one or two inches of a single rib is an operation unattended by danger, producing no deformity, and in most cases probably followed eventually by a complete restitution of the excised bone. General anaesthesia is usually necessary, and by many operators chloroform is preferred: the danger of an anaesthetic in most adult cases of empyema does not appear to be much greater than in other conditions.

Technique.

An incision, some three inches in length, is made down to the middle of the sixth or seventh rib in the axilla. The periosteum is them crowded to either side by the aid of an elevator, the rib firmly grasped with a strong forceps, and an inch and a half excised by one of the various rib-cutters or an ordinary Liston bone forceps: it is a considerable advantage to have avoided penetrating the pleura while disengaging the rib. After the latter has been removed the pleura is incosed, and one or two fingers are inserted in order to regulate the flow of pus, which should notbe too rapid: the finger is also swept about within on all sides of the incision for the purpose of thoroughly opening up its immediate neighbourhood. The wound is then drained and dressed as in simple incision.

SPECIAL FORMS of empyema require little deviation from the ordinary plan. In pulsating empyema or external fistula it is generally best to make a fresh incision in the usual situation. The same is true when rupture has occurred through the lung: no time should be lost in waiting for spontaneous recovery. In double empyema it is usually preferred to allow several days to intervene between the two operations.

The AFTER-TREATMENT of these cases is of great

importance, a most necessary part of which is IRRIGATION. At least for a long time this was the general opinion held. Of late, however, the idea has been steadily gaining ground that except in putrid cases all irrigation, even at the time of operation, should be omitted, as being not merely unnecessary, but harmful. Aside from the occasional grave accidents which attend its use, it seems that it tends actually to retard recovery. Runeberg, at the clinic of Helsingsfors (Zeit.f.klin.Med., xxi.), made the following remarkable series of observations: From 1876 to 1883, when constant lavage was employed during convalescence, there were thirty per cent, of cures and an average duration of one hundred and one days; from 1883 to 1885, under a single washing at the time of operation, there were seventy per cent. of cures, average eighty-four days; from 1885 to 1890, with absolutely no irrigation, the cures, in uncomplicated cases, reached ninety-six and a half per cent., and the average was only forty-eight days. While admitting the influence of other factors, he ascribes this improvement very largely to the suppression of irrigation. This also accords with the present practice of other authorities: Cabot and Lindsay irrigate only once, at the time of operation; among those who have entirely done away with lavage in ordinary empyema are Morrison, Holt, Beck, Bucquoy, Laache, and Koenig. The results obtained by the latter operator are so remarkable that it may be well to give his method in detail. His object is to effect the most perfect drainage possible. To this end the patient is instructed to lie as much as possible on the affected side. He is also subjected to a series of manipulations: at first four times, and later but two or three times daily, he is lifted by the legs and hips so as to rest for a moment on the shoulder of the affected side; he then assumes for a short time the semirecumbent, partly rotated posture; and, finally, he is lifted again as before. This same drainage from below may also be effected by the patient alone, who allows his shoulders to hang over the edge of the bed, supporting them upon the floor. Some writers advise irrigation in cases of putrid empyema, although here it would appear that an entirely free drainage without lavage is often sufficient to rapidly alter the character of the pus. Most surgeons prefer to wash thoroughly at the time of the operation with a very mild antiseptic - usually a three per cent. solution or boric acid or other approved drug - and to repeat this every day until a foetid odour can no longer be detected.

The matter of DRESSINGS is also of importance. Koenig advises the use of a very large and bulky occlusive dressing, thickly padded in the axilla and including even the arm. He generally finds it necessary to change the first dressing on the second or third day, but the subsequent dressing are frequently left for a week; the guide, in general, is the thermometer and the appearance externally of pus. Cabot recommends that a sheet of mackintosh be included in the dressing, believing that he thus favours a valve-like action of the latter which readily permits the escape of air, but prevents its entrance, so as to directly promote the re-expansion of the lung; it seems probable that any modern dressing exerts at least a certain tendency in